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ELECTRICALLY OPERATED FREIGHT LOCOMOTIVES.

For the movement of freight cars around terminal yards and docks, through city streets, and especially in tunnels, the electric locomotive has a great advantage over steam. The extremely low economy of switching engines used in this service renders the saving of fuel possible, especially if the electric locomotives take their power from street railroad systems. The electric locomotive is much quieter and less alarming in its appearance to the horses that must be used in the street with it, and it can be run into enclosures and freight houses without risk of damage from smoke and steam.

The chief consideration in the construction of an electric locomotive is to obtain as great a draw-bar pull as possible with the weight on the drivers. Speed is of little consideration. Such machines as built so far in this country have been mounted on two four-wheel trucks, with a motor geared to each of the four pairs of wheels. In starting, these four motors are thrown in series, and this particular combination has a very deleterious effect on the action, as may be seen from the following considerations. It is well known that the horizontal effort is much greater when the wheels stick than when they slip. If, therefore, any one pair of wheels for any local reason slips with the series combination, its horizontal effort will immediately fall off, and consequently the torque necessary to drive it. It will then speed up to such a point that the back E. M. F. of the motor will cut down the current to a value giving a torque just sufficient to overcome the reduced braking effect of the rail on the wheel rim. Being in series with all the other motors, their torque will be reduced to the same extent. In other words, any local slippery spot sufficient to start the slipping of one pair of wheels will reduce the horizontal effort of all four as much as though they were all slipping.

The coupling of the wheels by parallel rods similar to those in use by steam locomotives would obviate this difficulty, but it is highly objectionable for other reasons, and impossible where a two-truck machine is used. Other systems of electrical control can readily be devised to obviate this difficulty, one of the most promising of which is a modification of the Leonard system, using separately excited motors with fields fully saturated in starting and armatures supplied from a motor generator with adjustable secondary voltage. The slipping of any one pair of wheels with such a combination would immediately reduce its torque by reason of the increased back E. M. F. with constantly excited field, and thereby tend to stop the slipping without interfering in any way with the other motors. As increased weight on electric locomotives is rather more desirable than otherwise, the increased mechanism would not be objectionable.

CHANGE IN SIZE OF A CONTEMPORARY.

Mr. C. W. Price, the editor of our American contemporary, *The Electrical Review*, did a sensible thing in reducing the size of his paper to decidedly more convenient proportions. The size of the page is nearly that of THE ELECTRICAL WORLD, being of the same length, and but a trifle wider. Mr. Price is one of the best known and popular newspaper men in the electrical field, and he is to be congratulated on the improvement in his paper.

THE ELECTRICAL EQUIPMENT OF TI E MANHATTAN ELEVATED RAILWAY.

The president of the Manhattan Elevated Railway, Mr. George Gould, has made the following statement: "We have decided to introduce electricity on the elevated system, and we will now proceed to effect a general installation with as little delay as possible." This means the installation of a larger electrical equipment than any yet attempted. More than 300 steam locomotives are now in service, pulling four and five-car trains, the annual car mileage being in the neighborhood of 50,000,000 miles. It is intended to greatly extend this service by the addition of more tracks and extensions. The acceleration can be greatly increased even with motors on but one car of the five-car trains. With the present locomotives and tenders less than 20 per cent. of the train weight is on the drivers when the cars are filled. With motors on but one car the train will be much lighter than at present, the weight on drivers will be about 25 per cent. of the train weight, and the tractive effort vary much less with the rotation of the drivers.

In spite of the undoubted superiority of the electric motor over the steam locomotive for such uses, it is questionable whether this action at the present time is for the best interests of the stockholders of the Manhattan Elevated Railway. Although direct-current traction systems have shown a surprisingly satisfactory solution of the traction problem they are not perfect. A rival is making its appearance and threatening to displace them. Alternating current motors have shown most remarkable adaptability to every service in which they have as yet been tried, including the most severe, and the great advantages of the alternating current in the matter of transmission and transformation render it probable that, as soon as any serious attempts are made to perfect the apparatus alternating currents will be found superior to direct for traction purposes. In the development, however, some roads will necessarily be first and they are likely to suffer a certain amount of martyrdom for the benefit of their followers, a fate which naturally none of them desires. The almost imperative necessity, however, of alternating currents for the operation of long-distance electric roads will probably supply these martyrs to the cause. Two roads in Europe, described in another column of this paper, have already adopted the alternating system, and their martyrdom appears to be a pleasant one. Several other such lines are under construction. In this country the enormous amount of capital invested in direct-current traction apparatus will probably make the development slower than in Europe.

THE CHIMNEY AS AN AIR PUMP.

The most important duty of a chimney is the creation of a partial vacuum above the fire sufficient to draw the air needed for combustion through the interstices of the burning fuel. The action is simple, the column of heated air inside the chimney being lighter than the cold air outside, and the downward pressure from the top of the stack inside the chimney to the top of the fire being less than from the same point outside down to the under side of the grate. The heavier pressure outside tends to force air through the fire and this air becoming heated makes the process continuous.

Although ideal in point of simplicity, in the other features of efficiency and effectiveness this process is sadly lacking. Its operation obviously requires the discharge of the products of combustion into the stack at a considerably higher temperature than that of the external air, and this involves a great waste of energy. To produce a draft sufficient for hand firing with stacks of reasonable height requires a flue temperature of approximately 500° or more. With the uneven fires and intermittent stoking of hand work and consequent excess of air over that required for perfect combustion, this requires a loss of somewhere between 15 and 25 per cent. of the available energy in the coal.

A great part of this lost energy could be retained by the use of economizers, feed-water heaters, or finally by the use of a device by which the fresh air instead of being introduced cold under the fire could first be heated by the hot air escaping to the up-take flues. In case any such refinement as this were used, however, the gases in the up-take would be too cold for proper draft-producing purposes, and mechanical draft would be necessary. The extremely small amount of power necessary for the production of mechanical draft in comparison with the large amount to be saved by proper cooling of the gases may make this a profitable refinement.

THE GROUPING OF SECONDARY LOADS.

Most lighting systems operating high tension distribution mains in the districts of scattered population have made a practice of putting in small transformers, supplying as a rule one customer, or at the most two or three from each transformer. This habit naturally grew up in the days when 50 volts was the accepted secondary pressure; because of this low pressure proper distribution over any considerable area by means of secondary mains was impossible without a prohibitive amount of copper. Every transformer was necessarily of sufficient size to carry the largest load which might come upon it only very rarely. For example, in the case of a private residence supplied with some thirty outlets, a transformer capable of carrying twenty lamps would be necessary in order to serve in case of any social festivity requiring a general lighting of the building. This occasion might arise twice a year, the maximum load at any other time being one-half or less of the rated load of the transformer, and the average load in twenty-four-hour service the year around perhaps anywhere from 2 to 10 per cent. of the rated load. These figures may seem extreme, but there is no doubt that the majority of transformers in house service are loaded in very much this manner. A core loss of 3 or 4 per cent. of the rated load of the transformer would thus cause the average yearly efficiency to fall to a most alarming figure anywhere from 30 to 60 per cent.

Neglecting for the moment the reduction in the core loss of one large transformer below that of a number of smaller transformers aggregating the same capacity, the grouping of a large number of secondary loads on one transformer may be made to cause a considerable saving for the following reason: All the loads will not simultaneously reach their times of specially heavy demand, and the one transformer supplying them need only be made sufficiently large to carry the average load at the peak of the daily curve. In this way very often, to cite a concrete example, a 100-light transformer may carry loads which, if divided, would require some eight or ten 20-light transformers. Added to this is the greatly reduced core loss per light of the larger transformer, and the combination is sufficient to render advisable the grouping of loads even to the extent of running a completely interconnected secondary system of wiring in most instances.

This grouping, especially in the extreme case of building secondary wiring systems, requires considerable copper, and renders advisable the use of high tension secondaries of some nature. The 50-volt secondary is now an anachronism. One hundred volts or more is the lowest pressure that should be used. Two hundred volt two-wire secondary systems are hardly advisable as yet, owing to the lower efficiency of the 200-volt lamp, as compared with that of 100-volts. Whether this condition will continue is problematical. Three-wire secondary systems, with 200 volts or more between the outside wires, are generally desirable, especially as the balancing of the system is so easily effected at any point with alternating currents by simple inductive balancing coils.

The Electrical Machinery of Brown, Boveri & Co.—II.

BY A. E. LEVIN.

As a large part of the plant designed by the firm is intended for water-power stations where the fall is limited, it has been found advisable to create a set of types for coupling directly to the vertical shafts of low-speed turbines. This so-called "umbrella" type

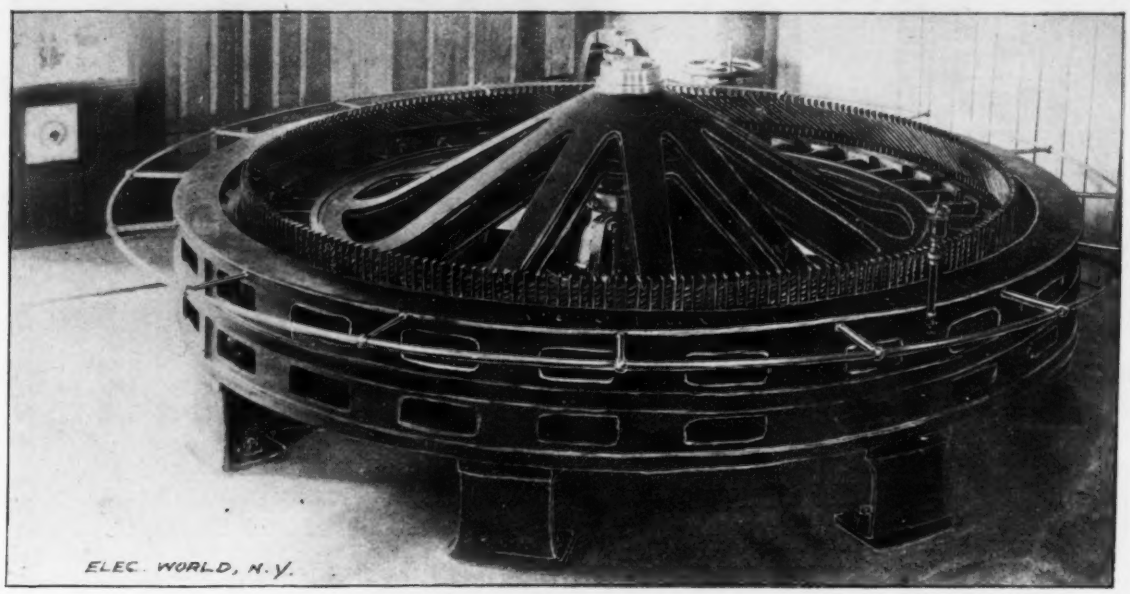


FIG. 11.—BELLEGARDE GENERATOR, 800 H-P.

is shown in Figs. 11, 12 and 13. Fig. 11 represents a generator for 800 horse-power at 130 r. p. m., built two years ago for the Rhône Land & Water Power Company, an English company owning a valuable water-power plant on the Rhône, at Bellegarde, about 15 miles below its effluence from the Lake of Geneva. As the power is only distributed in the neighborhood of the village a tension of only 1000 volts has been adopted, so that the armature winding is of solid copper rods, with end connections arranged on the surface of the cylinder, as in the case of the machine first described. The armature is smaller than that used in the fly-wheel type of machine, but instead of being supported on spider frames it is placed horizontally on a star-shaped pedestal. This pedestal carries two bearings for the vertical shaft, the upper one being exactly in the plane of the armature, so as to take up directly any magnetic pull which might arise, the conical "umbrella" shape of the magnet wheel permitting this arrangement. This design was first proposed by Messrs. Brown, Boveri & Co. in their tender for the Niagara Plant. The weight of the revolving part is usually taken by the turbine shaft, but in some cases one of the dynamo bearings is arranged to take the thrust. Figs. 12 and 13 represent parts of a 1200-hp three-phase generator in course of construction. It is one of a set which is being built for an important power distribution plant in Lyons. The water power available amounts to 20,000 horse-power, but for the present 10,000 horse-power, representing eight of these machines, is to be utilized. Four of the generators are already installed, and the others will be shortly in place. The speed of these generators will be 120 revolutions, as the fall is low. The distribution will be effected at a tension of 3500 volts. It will be noticed from Fig. 12 that the winding in this case is of cable, braided with cotton. The total weight of the magnet wheel with its poles and windings is 19 tons, and of the armature, without its pedestal, 17 tons. A similar machine is being erected at the Bellegarde generating station as an extension of the present plant, and two more have been ordered by the city of Geneva for their water-power station at Chêvres.

In some cases exceptionally low speeds have been adopted. Thus, last year, Messrs. Brown, Boveri & Co. turned out what are probably the slowest running dynamos in the world. They are six in number, and are running in the power-house of the Olten-Aarburg Company in Ruppoldingen, giving 300 horse-power each, at a speed of 28.5 revolutions. They give 5000 volts two-phase current, and the power is distributed for various industrial purposes within a radius of about 9 miles.

Since his establishment in Baden, Mr. Brown has devoted a good deal of time to the development of a really practical single-phase alternate current motor. Such success has attended his efforts that no less than 1500 such motors have now been turned out from the works, the power varying from one-tenth up to 100 horse-power. These motors are similar in general design to the three-phase motors shown in Figs. 14 and 15, but are provided with two windings only, the working and the starting winding. This latter winding is placed in parallel with the first during the period of starting only, an electrolytic pseudo-capacity being inserted in series with it, so as to give a leading current. Motors up to about 7 horse-

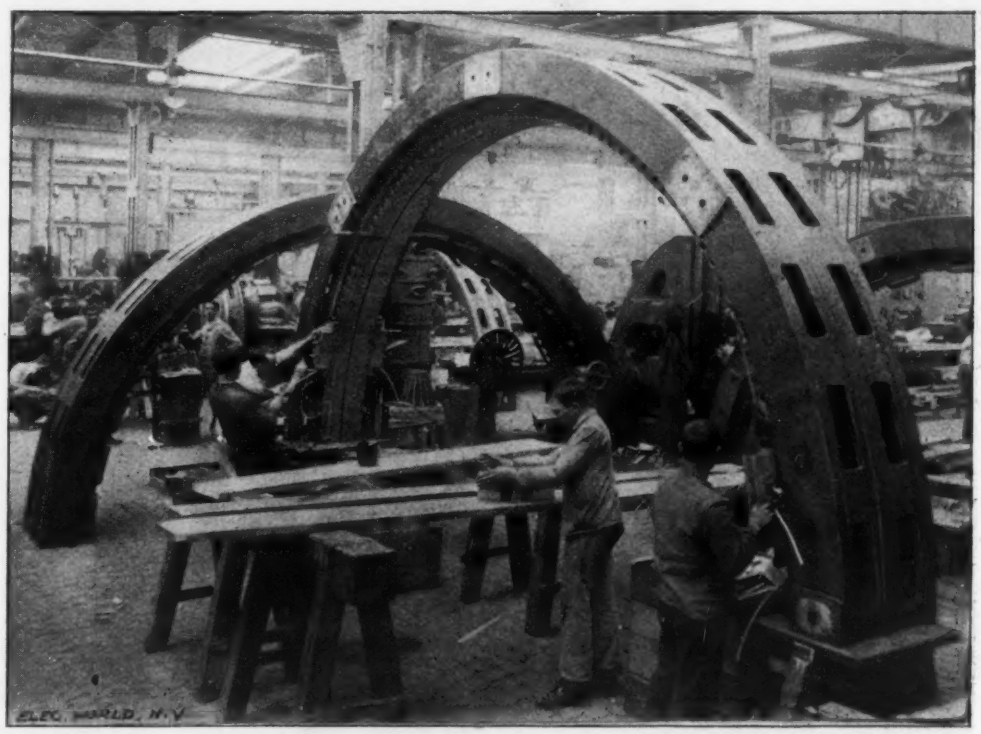


FIG. 12.—1200-HP GENERATOR FOR LYONS. ARMATURE SECTIONS IN WINDING SHOP.

power are usually made with short-circuited rotating parts; but above this size the "rotor" is wound, and the ends of the winding brought to three sliding contact rings to allow of the insertion of starting resistances. It may be mentioned that in the city of Frankfort alone these single-phase motors, to the extent of 1200 horse-power, are now running off the public supply circuits. It is often urged against the use of single-phase motors that they will not

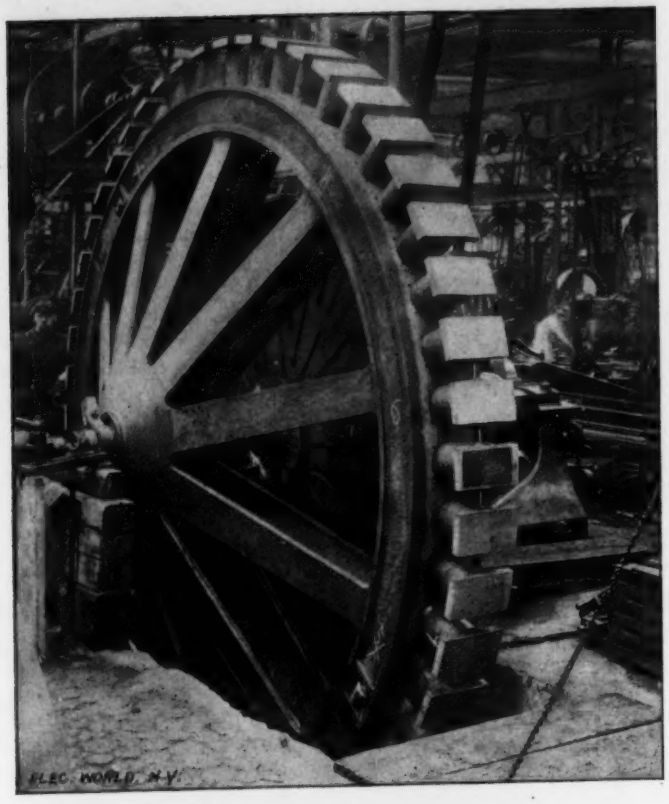


Fig. 13.—Magnet Wheel of 1200-hp Generator.

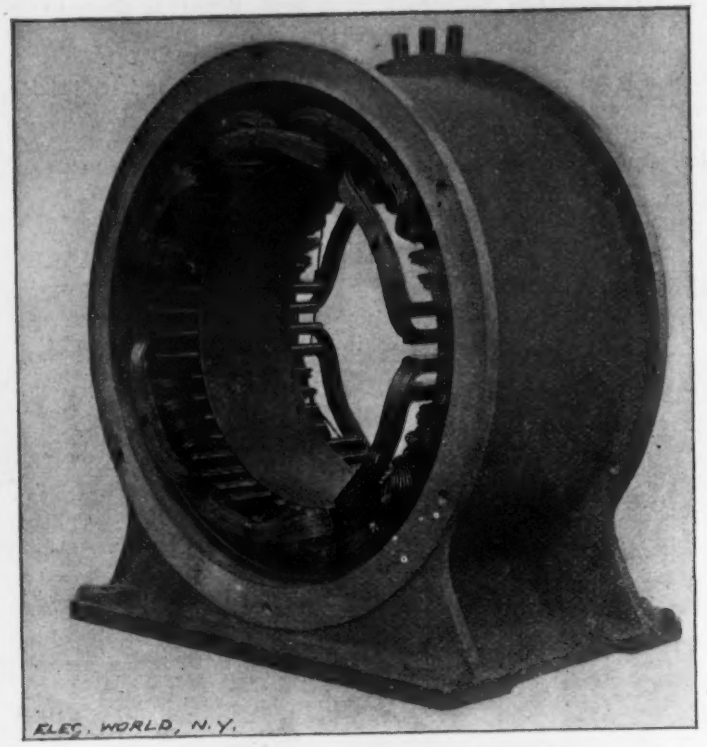


Fig. 14.—Fixed Part of Three Phase Motor.

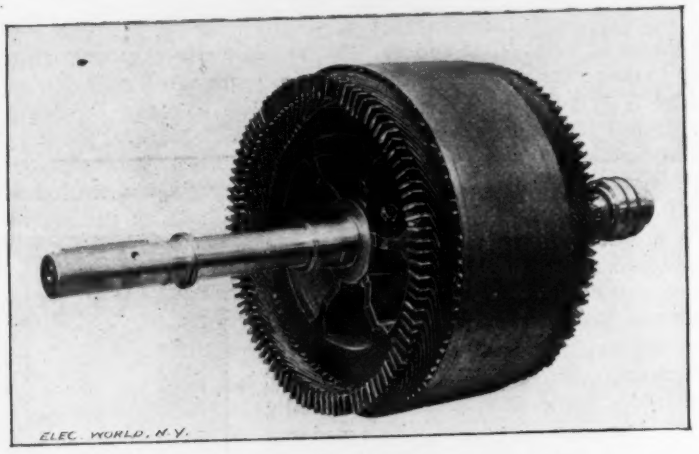


Fig. 15.—Rotating Part of Three-Phase Motor.

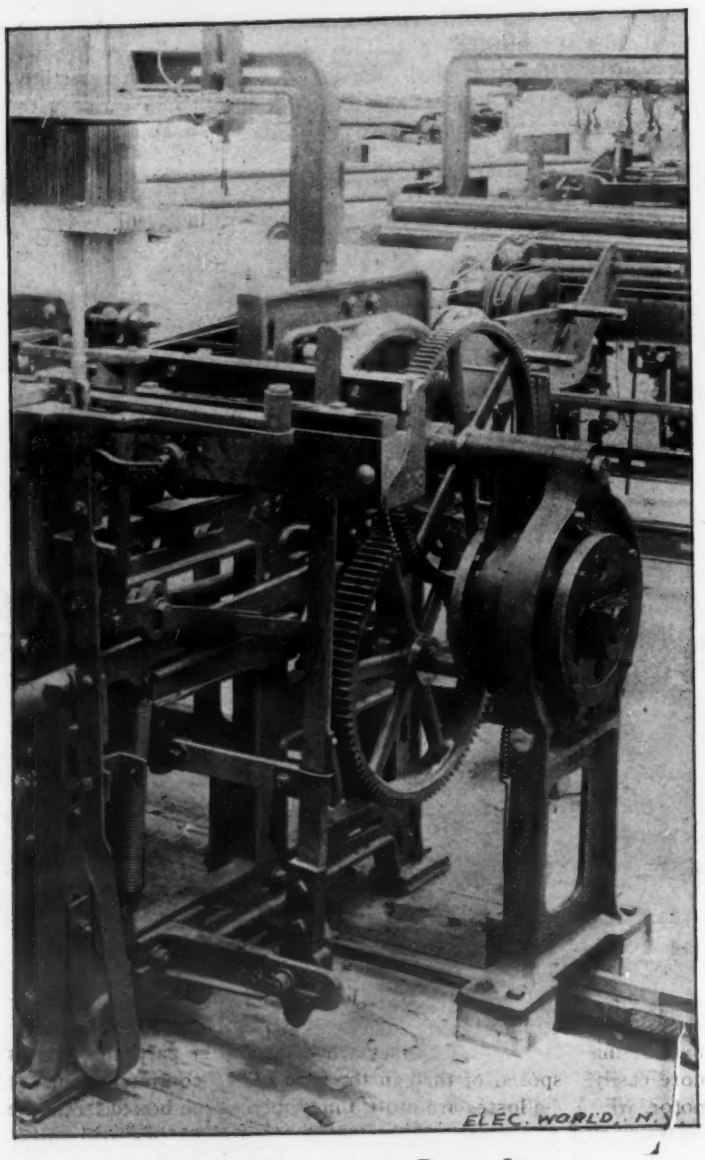


Fig. 17.—Electrically Driven Loom.

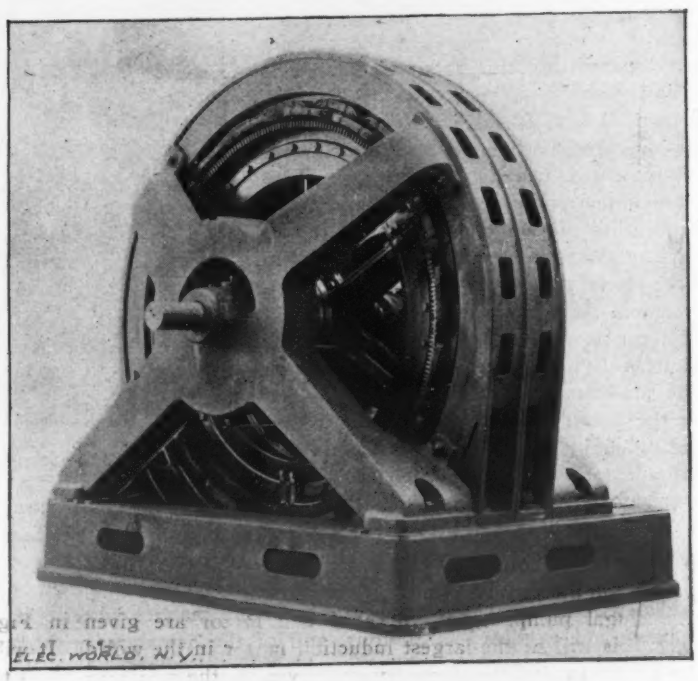


Fig. 18.—300-hp Motor.

start against a load, but when we consider that thousands of gas engines are in use in all parts of the world it will be seen that the objection is no valid one, as these, far from starting against a load, actually require to be pulled round by hand. Single-phase motors are usually arranged with a fast and loose pulley on the countershaft to facilitate starting, but they can be made to start with a light countershaft belted to them.

The multiphase motors of the firm are also well known. Figs. 14 and 15 represent respectively the fixed and rotating parts of such a motor. The smaller sizes, up to 15 horse-power, are made with short-circuited rotors, but above this size they are made with wound rotors and starting resistances. Some results of tests with a three-phase motor of 20 to 25 horse-power are given in Fig. 16. It will be seen that the efficiency attained is 92 per cent.; and that the motor only requires 900 apparent watts per horse-power.

A large number of motors have been applied directly to the driving of looms, as shown in Fig. 17. The size usually employed gives one-half horse-power at 1200 r. p. m., and has an efficiency at full load of 75 per cent. The motor drives the loom shaft by means of a rawhide pinion gearing into a cast-iron wheel, with machine cut teeth. In order to take up the irregularities of the power required by the loom, caused by the reciprocating motion of the shuttle, as well as to ease the

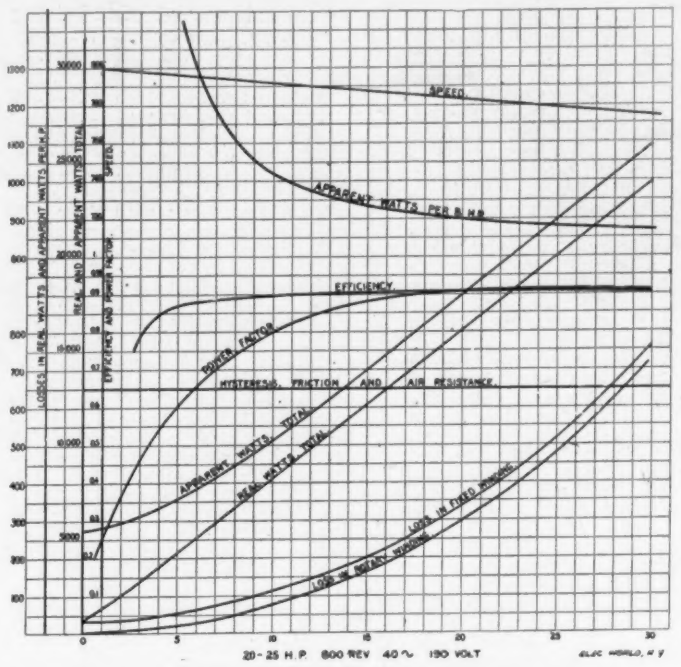


FIG. 16.—CHARACTERISTICS OF THREE-PHASE MOTOR.

The large number of multiphase motors supplied by the firm for use on cranes and other purposes in which exceptionally heavy starting torque is required suggested to Messrs. Brown, Boveri & Co. the possibility of employing the three-phase system directly for traction, without the use of rotary converters. The first line carried out on this system was the tramway from the town of Lugano, in Italian Switzerland. It was desired to utilize a water power situated at a distance of 7½ miles from the town. The cost of copper for supplying directly would have been relatively heavy, while the comparatively small amount of traffic did not justify the use of continuous current transformers or rotary converters, owing to the attention required. It was therefore decided to fit the tramcars with three-phase motors, taking their current from a double trolley line, with the rails as the third conductor, ordinary alternate current transformer being employed to transform down from the transmission tension of 5000 volts to the trolley tension of 350. This bold move proved a complete success, so that the proprietors of the line, who have already had experience with continuous current tramways, declare that there can be no comparison between the two systems for simplicity and reliability. Figs. 20 and 21 represent the motor with axle, and a view of two cars.

The oft-heard objection that the motors will not start sufficiently vigorously has been proved to be completely ground-

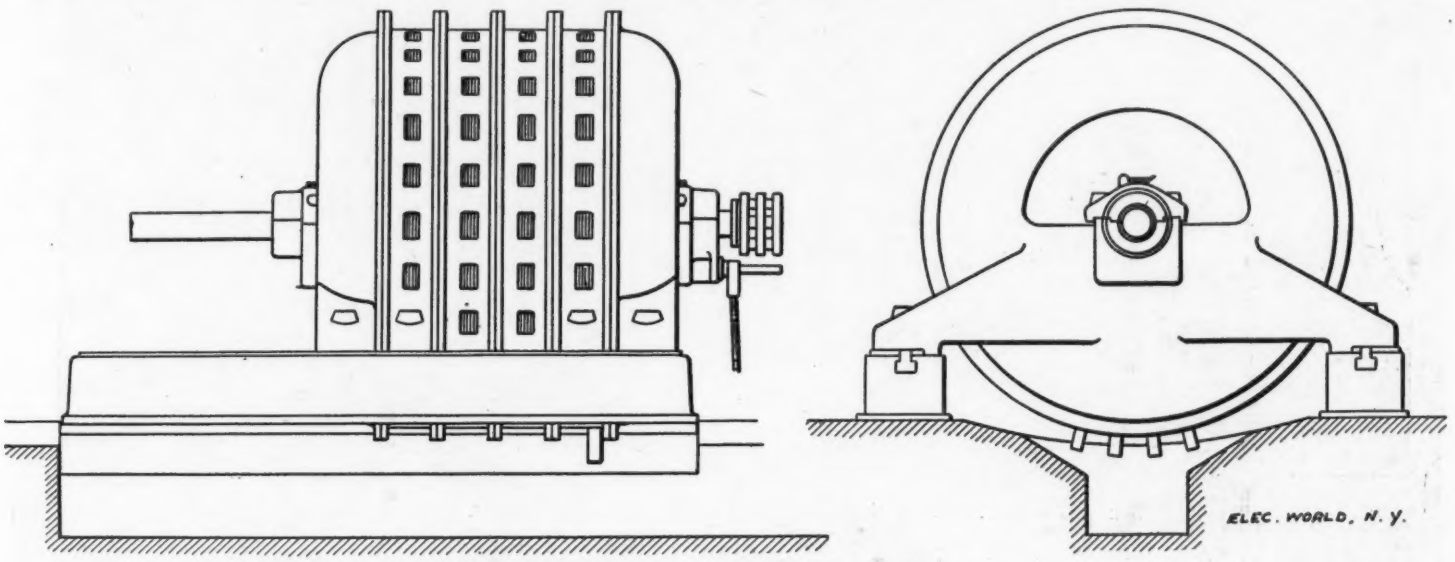


FIG. 19.—1000-HP MULTIPHASE MOTOR FOR GENEVA.

shocks at starting and stopping, the motor is suspended on springs. Tests which have been made with such a motor show that the power required with this arrangement is to that required with the same gearing, but without springs, and to that required for a belt drive, using the weight of the motor to stretch the belt, as 165 to 195 and to 240 respectively.

The larger motors are built for high tension without the use of transformers. Fig. 18 represents one of two motors which are used to drive a cotton mill in Italy, the power being transmitted at 3000 volts, and employed directly in the motors. Each motor gives 300 horse-power at 200 r. p. m. Messrs. Brown, Boveri & Co. have at present under construction a motor for an output of 1000 horse-power for the city of Geneva, to be coupled directly to a high-lift centrifugal pump. Two views of this motor are given in Fig. 19. This will be the largest induction motor in the world. It will be driven by the two-phase current given by the new generators to be put down in the power-house at Chêvres, as mentioned above.

less. It may be pointed out that the torque of any motor, whether for continuous or alternate current, is dependent on the product of the current through its armature into the field in which it is placed. In a continuous current series motor, the field cannot be increased more than about 50 per cent. on account of saturation setting in, so that beyond this limit any increase of torque is obtained only by a proportionate increase of current. The same law applies, of course, to multiphase motors, where the field, being dependent on the tension, is usually constant. The torque therefore, whether at starting or at full speed, is proportional to the current strength, and the three-phase motor is certainly at least as well able to carry excessive currents at starting as the continuous current type. Owing to the fact that the principal losses are in the outer part, the heat is more easily disposed of than in the case of the continuous current motor, where the losses are mostly in the armature boxed in by the fields.

Further, it is always possible, by changing the connections

from "star" to "triangle," to increase the field by 73 per cent., and so get a corresponding increase of torque without increase of current, for it must be remembered that the multiphase motor works normally with a much lower magnetic density than the continuous

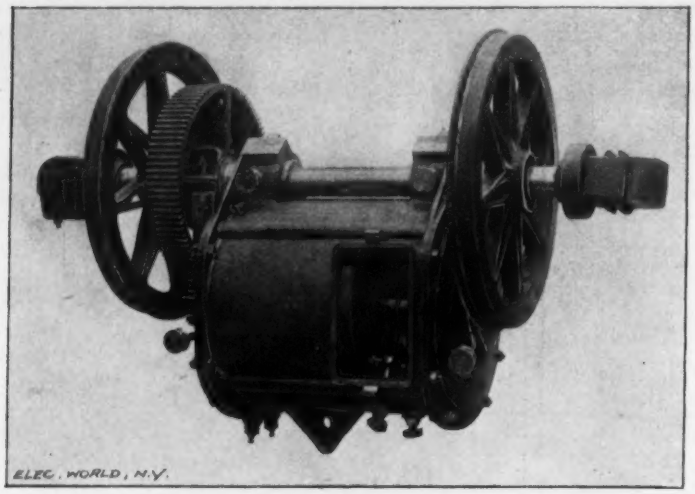


Fig. 20.—Motor and Axle of Three-Phase Tramway.

Coming to continuous current traction, the electrical equipment of the famous Heilmann locomotive may be of interest. It will be remembered that this locomotive carries a boiler and steam engine coupled directly to two continuous current dynamos. The current from these is used to drive twelve motors mounted directly on the axles, though with flexible couplings to take up the shocks. Fig. 23 represents one of these motors, the shaft being made hollow to allow the axle to pass through. Each of these motors will develop 120 horse-power at 400 r. p. m. The armature is of the drum type, wound in slots, with the conductors bent to shape on a template, and soldered together after being placed in the armature, so as to form the well-known Brown cylindrical winding.

Fig. 24, which is a view in the erecting shop, shows the magnet frame of a continuous current machine for 1000 horse-power at 85 r. p. m., intended for a central station in Paris. It will be noticed that the frame is divided vertically, and placed on sliding beds, so that the two halves may be drawn apart for the inspection and cleaning of the armature.

For the large amount of extra high tension work carried out by the firm a special class of switchboards and apparatus has been designed. One of the main principles laid down for the construction of this work is that all parts carrying high tension current shall be behind the board, so that the attendant runs no risk of accidental contact while performing his duties. All high tension conductors are carried on porcelain insulators, thus insuring the highest possi-

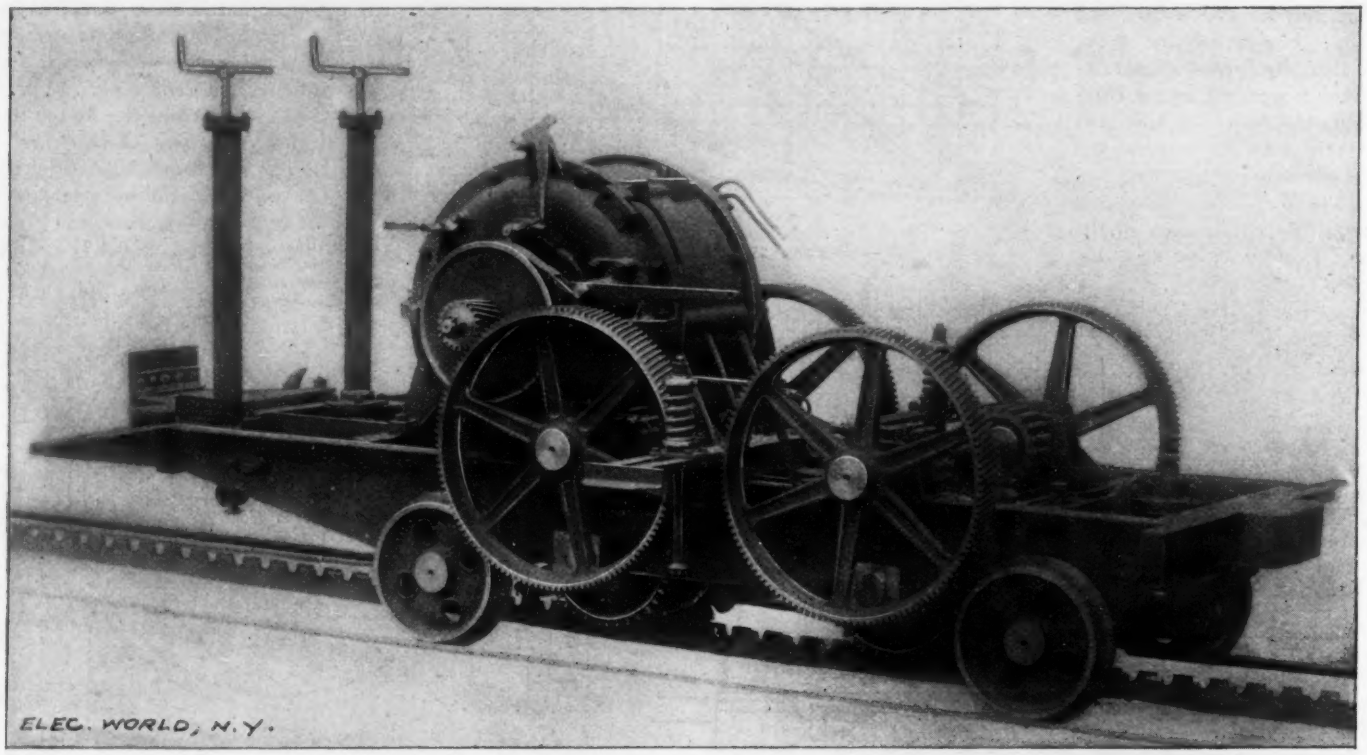


Fig. 22.—Three-Phase Electric Locomotive for the Gorner Grat Railway.

current type. But this change of connections is not usually necessary.

But, after all, the proof of the pudding is in the eating, and the success of the Lugano tramway is sufficiently shown by the fact that the same system has been adopted for the Gorner Grat Railway, the Engelberg line and the standard gauge line from Burgdorf to Thun, for all of which lines Messrs. Brown, Boveri & Co. are supplying the electrical equipment. Their project for the tunnel railway up the Jungfrau received the premium offered, and the system has been adopted for this line also. They have just delivered the electrical equipment for one of the locomotives.

The trial trips on the Gorner Grat Railway have recently been made in the presence of the inspectors of the Swiss railway department. Fig. 22 shows one of the locomotives with one motor in place and without the casing. Each of the two motors gives out 90 horse-power at 800 r. p. m., and will absorb this power in descending, returning it to the line in the form of current, which is taken up by a water resistance in the power-house, if there should not happen to be cars ascending at the time. The locomotives for the Jungfrau railway will be similar to those for the Gorner Grat.

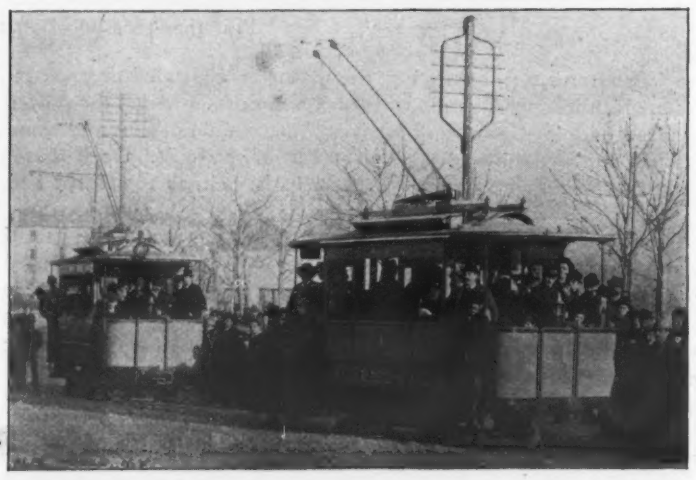


Fig. 21.—Pioneer Three-Phase Tramway in Lugano.

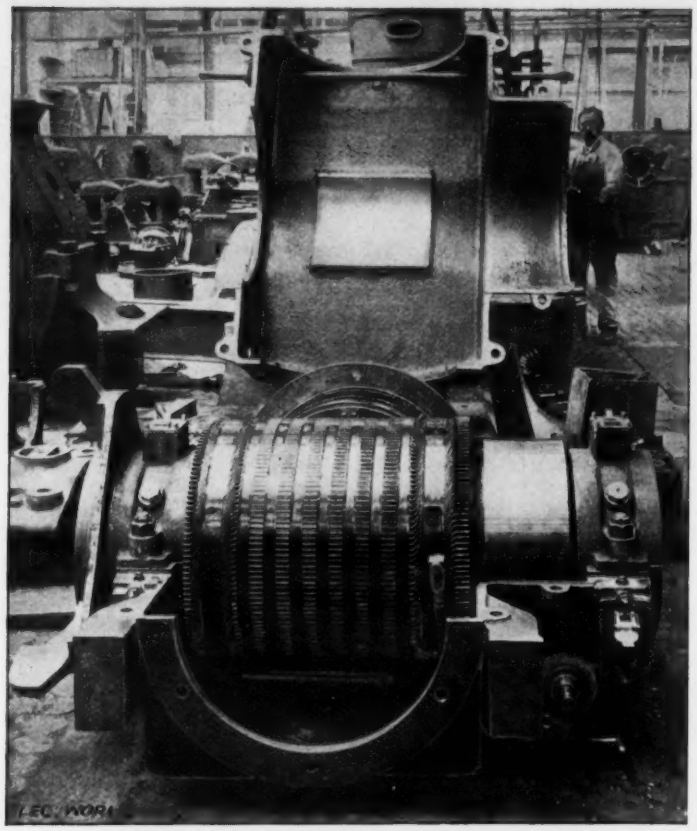


FIG. 23.—120-HP CONTINUOUS CURRENT TRACTION MOTOR.

ble security. Figs. 25 and 26 show the front and back view of such a board, designed for a generator of 5000 volts. For large stations a number of such boards are placed side by side, with further panels, if necessary, for the lines. It will be seen that the switch has a double break for each pole, and plates of slate are placed between the separate pairs of contacts to prevent short-circuiting by the arc which forms on opening circuit. All the contacts of the switches are mounted on porcelain insulators. At the extreme back of the frame are the fuses, which are the result of much experimenting. Very excellent results have been obtained with them. Thus it has been found perfectly possible to break a circuit having over 1000 kilowatts passing in it. For the 15,000 volt plant at Paderno the switchwork will break circuit under oil, thus entirely preventing the arc.

At the present moment the firm is exceedingly busy, no less than twenty-four machines of 1000 horse-power and upwards being in process of completion, while the total output of the machines now in hand amounts to no less than 50,000 horse-power.

A Third Rail Line in Germany.

Electric power is to be given a trial on the Wann See between Berlin and Zchlendorf, a distance of about 7½ miles. According to the London *Electrical Engineer*, the current is to be fed to the train from a conductor rail at the side of the track and 1 foot above the service rails. Insulators will support the former at intervals of 4 or 5 yards, and will be themselves carried upon wooden saddles, attached to the ends of the cross ties. A trial train is to be equipped, the weight with the load being 210 tons. The regular service will necessitate fifteen round trips per day. Motor-driven air compressors will be supplied to work the present brake equipment, and trials will also be made with an electric brake. Accumulators will be placed on the cars to steady the voltage on the lights.

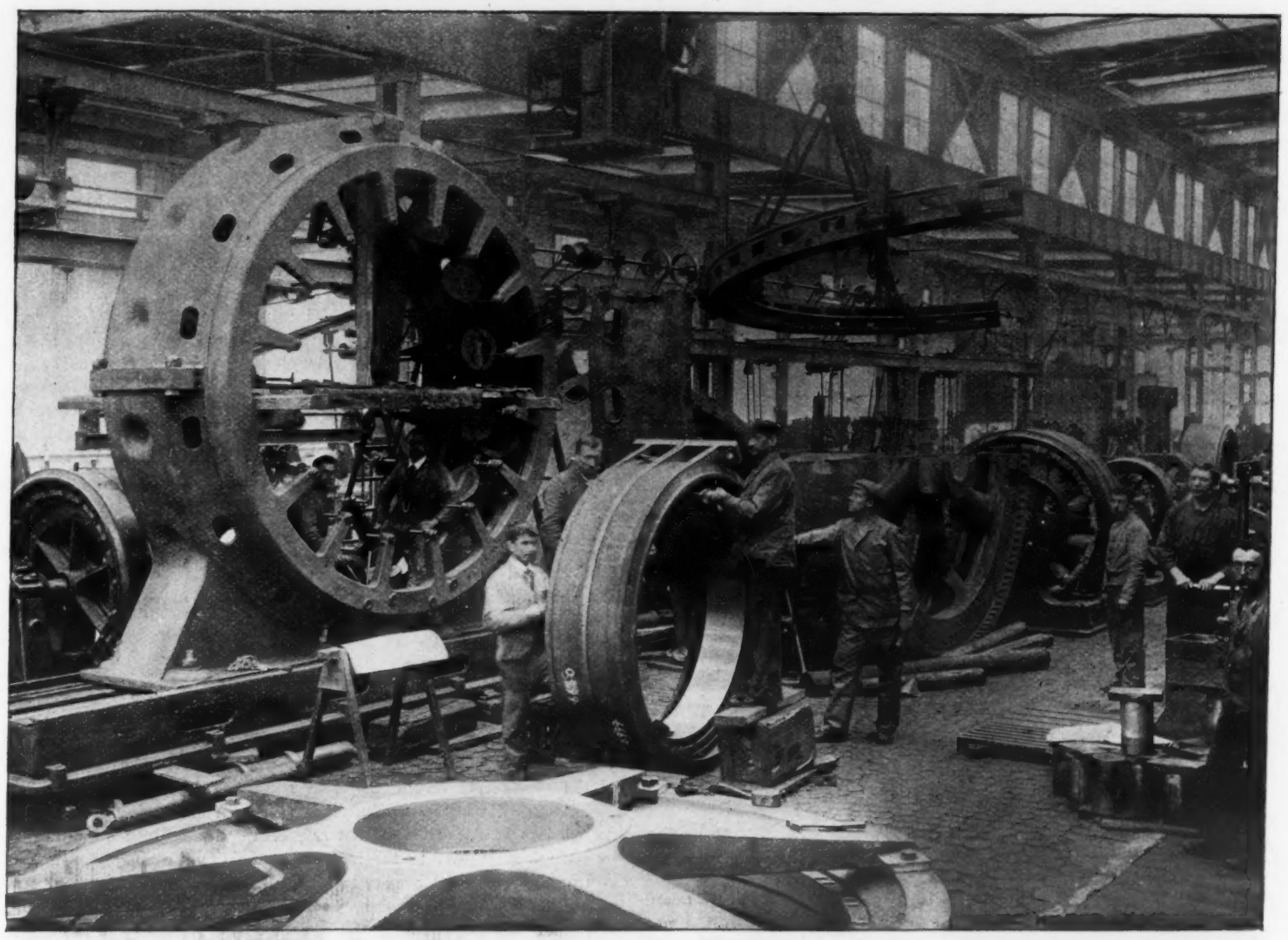
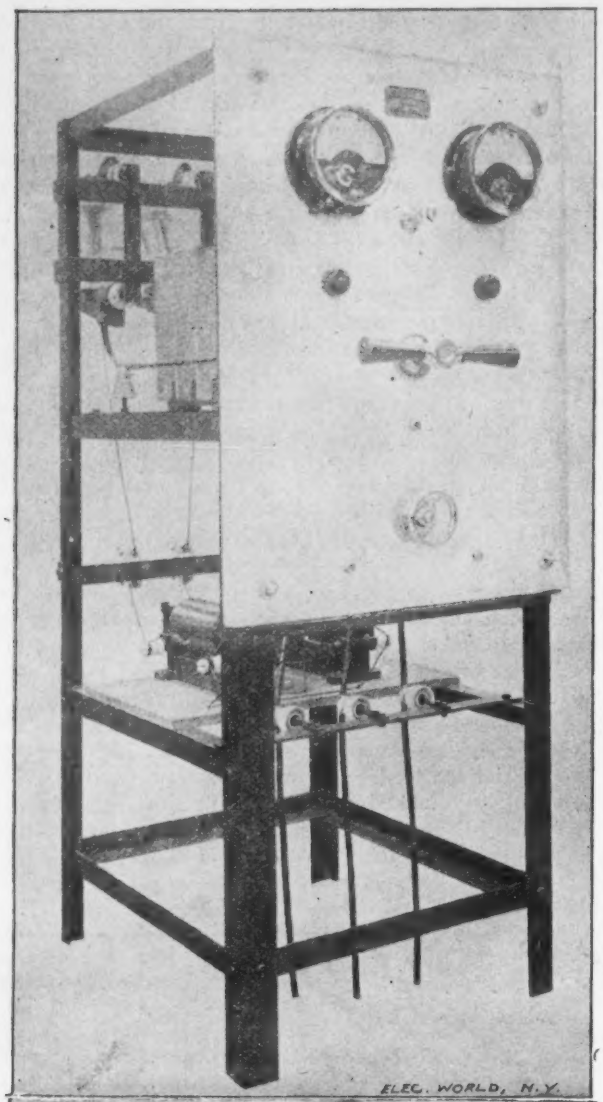
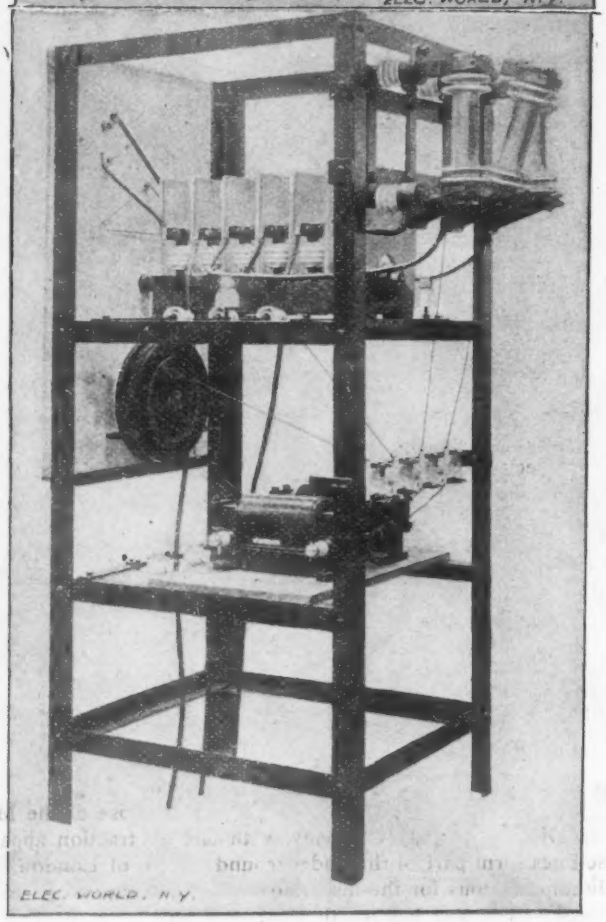


FIG. 24.—ERECTING SHOP SHOWING FRAME OF 1000-HP CONTINUOUS CURRENT GENERATOR.





Figs. 25 and 26.—Views of Brown, Boveri Switchboard.

Electricity from Coal.

BY C. J. REED.

The method of obtaining electrical energy from coal or carbon in the electric generator of Prof. Sidney H. Short, which has been recently described (see Electrical World *Digest*, December 25. 1897) as operating in conjunction with a coke-producing gas plant, is more fully described in an earlier patent issued to Professor Short, October 13, 1896, from which the accompanying figures are taken.

This battery belongs to the same class of "heat cells" as the Archereau or Jacques cell, with the difference that Short uses lead oxide, PbO, as the oxidizing agent, it being at the same time the electrolyte, while Jacques used an oxide of iron as the depolarizer, contained in a fused mass of alkaline hydrate. In both batteries carbon is the oxidized substance, and forms the negative pole of the battery. In the Jacques cell the containing vessel is of iron, and is the positive pole of the element, while in the Short cell the positive pole is a mass of melted lead, *B*, Fig. 1, in the bottom of the containing vessel, *A*. *G* is the carbon holder dipping into the fused lead oxide, *B*, and containing the coke, *E*. *J* is a pipe for introducing air to oxidize the lead.

From a commercial standpoint the Short cell is certainly far more promising than the Jacques. It is at least free from certain defects which are present in the Jacques cell, and are fatal to its commercial use. It seems now to be pretty well established, notwithstanding the claims made to the contrary, that the chemical reactions of the Jacques cell necessarily convert its electrolyte into a carbonate, which must by replaced by fresh alkali weighing many times as much as the carbon consumed. This feature is entirely absent in the Short cell, and if we assume the carbon to be pure, there ought to be no by-products of any kind except carbon dioxide. This assumption would be nearly realized if wood charcoal or coal containing only a small percentage of ash could be used in the cell.

Carbon containing much silica would be unsuited for consumption in this battery, as every pound of silica, SiO_2, in the ash would convert 6.9 pounds of lead into a silicate or slag which would probably have to be smelted in another furnace to recover the lead. This silicate would rapidly destroy the iron parts of the apparatus if it were allowed to come in contact with them. The lead oxide would also rapidly oxidize metallic iron. It seems highly improbable, therefore, that iron would be a suitable and durable material for the carbon holder, as has been claimed. But if a suitable material can be found for this apparatus, Professor Short has in his battery overcome a very serious defect that exists in all primary batteries in practical use. This defect is the inability of primary batteries generally to use up their active material without destroying an expensive part of their mechanical structure, the renewal of which costs more than the material consumed.

Whatever the practical value of the cell may be, there is one thing that Professor Short has made very clear; that is, the electro-chemical reaction that takes place in the battery. The reaction is what is called "substitution," or the displacement of one element from a compound by another element taking its place. In the reaction of this battery the element carbon displaces the element lead from the compound, lead oxide, setting the lead free, or reducing it to the metallic state. This reaction is represented in equation (1),

$$2PbO + C = CO_2 + 2Pb \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

and is similar to that of many other batteries, such as the copper-sulphate, silver-chloride, mercury-sulphate, zinc-copper alkaline and the Jacques. Their reactions are shown in equations 2 to 6 respectively:

$$Zn + CuSO_4 = ZnSO_4 + Cu \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$
$$Zn + 2AgCl = ZnCl_2 + 2Ag \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$
$$Zn + HgSO_4 = ZnSO_4 + Hg \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$
$$Zn + CuO = ZnO + Cu \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$
$$3C + 2F_2O_3 = 3CO_2 + 4Fe \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

The combination of the product of oxidation with the alkali-metal of the electrolyte in the last two equations has been omitted, as that reaction is not one involving oxidation and reduction. In all these cases it will be seen that one element goes into combination by reducing another to the free state. In (2) the zinc gets its sulphuric acid from the copper sulphate; in (4) from the mercury sulphate. In (3) the zinc gets its chlorine from the silver chloride, and in (5) its gets oxygen from the copper oxide. Similarly in the Short battery, (1), the carbon gets its oxygen from the lead oxide, and in the Jacques battery (6) it gets oxygen from the iron oxide.

The belief that free or uncombined oxygen may take part directly in an electro-chemical reaction does not seem to be supported by any facts, the oxygen being in all cases derived from the decomposition of a compound containing it. Free oxygen may be successfully employed in regenerating the exhausted depolarizer or oxygen compound, but the only energy obtainable from that reaction is heat.

Professor Short has, in the specification of his patent, so clearly stated the nature of such reactions that he is well worth quoting. He says:

"In an arrangement such as above described the carbon is slowly consumed through the electro-chemical action of the electrolyte,

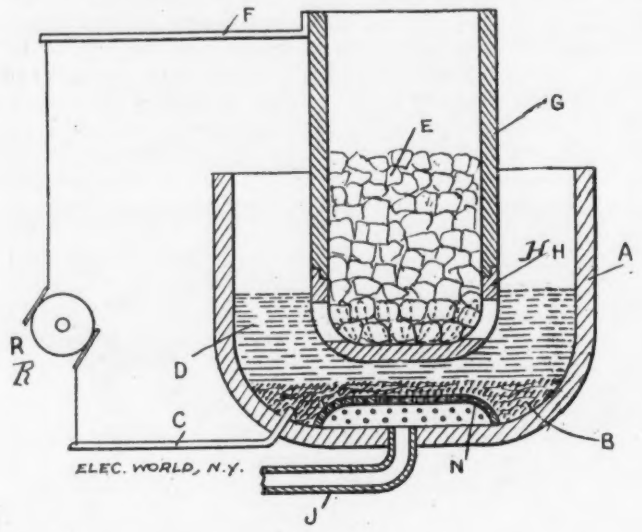


FIG. 1.

the metal constituent of the electrolyte being deposited upon the negative plate, *B*, or metal employed as the negative plate, while carbonic acid gas is developed or generated through the oxidation of the carbon, and which is carried off into the air. If this action should continue without more oxygen being supplied to the electrolyte, it is evident that eventually the electrolyte would become exhausted of oxygen, which would pass off in the form of carbonic acid gas, while the metal constituent of the electrolyte would be deposited upon the negative plate in the free state, and hence the action of the cell would cease. It is important, therefore, to supply oxygen to the electrolyte. This may be accomplished in many ways. For instance, and by way of illustration of the principles involved, I may introduce air to the electrolyte, whereby the supply of

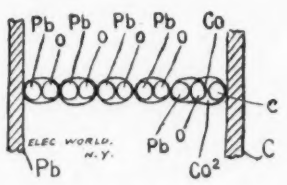


FIG. 2.

oxygen in the electrolyte is replenished. The mere introduction of oxygen to the electrolyte, however, is insufficient, and does not result in a satisfactory production of E. M. F. It is necessary, in order to secure satisfactory results, that the oxygen first attack the metal of the negative plate in order to convert a portion thereof into oxides which in turn form the electrolyte, and which acts as a medium of transference for the oxygen during the electro-chemical action which takes place."

He illustrates diagrammatically the theory of the reaction in Fig. 2. One of his claims states the process very concisely as follows:

"The method of converting the potential energy of carbon into electrical energy, which consists in subjecting the carbon to the electro-chemical action of a decomposable electrolyte containing oxygen, and capable of yielding its oxygen, and then regenerating such oxide through the agency of the negative plate by the addition thereto of fresh oxygen."

While it is very evident that the electro-chemical reaction of this cell is one of substitution, like that of the Daniell cell and others cited above, it is interesting, theoretically, to note that the chemical reaction of the cell, $2PbO + C = CO_2 + 2Pb$, like the reaction of the Jacques cell, and most cells requiring heat, does not evolve any energy. Its thermal equation:

$$\left\{\begin{matrix}2 \times 50.300\\ 2PbO\end{matrix}\right\} + C = \left\{\begin{matrix}96.960\\ CO_2\end{matrix}\right\} + 2Pb,$$

shows that 3640 calories of heat must be absorbed, and that there is a counter E. M. F. opposing the oxidation of the carbon equal to

$$\frac{3,640}{4 \times 23,260} = .039 \text{ volt.}$$

The real source of the E. M. F. in this cell is, therefore, heat, and not chemical affinity.

The fact that the source of E. M. F. is thermo-electric inversion need not necessarily militate against the efficiency of the process, as some have supposed. The regeneration of the lead oxide by reoxidiidation of the lead evolves heat enough to raise the temperature of the lead oxide produced about 2000° C. above the temperature of the materials before combining. This heat would also be sufficient to raise the temperature of the lead oxide produced and the nitrogen of the air used about 1000° C. above the temperature of the materials before combining. This heat would be rapidly given up to the surrounding mass, and would be utilized in raising the temperature of the hot junction (surface of contact of the metallic lead and lead oxide) far above the temperature of the carbon. There is no apparent reason to doubt that, at the time of their formation, the temperature of the molecules of lead oxide would be high enough to render thermo-electric transformation possible at an efficiency of even more than 50 per cent.

The Dangers of Impurities in Acetylene.

In a recent lecture Prof. Vivian B. Lewes, an authority on the manufacture of gas in England, stated that the purity of the materials used in the manufacture of calcium carbide was highly important. The coke, particularly, should be free from anything more than a tract of sulphur, phosphorus or silica compounds. If any appreciable amount of these impurities is to be found in the coke used in the manufacture of carbide, the resulting acetylene will contain phosphoretted hydrogen and similar gases liable to spontaneous ignition, and giving off on combustion products dangerous to health and destructive to fabrics. The lecturer also dealt with the explosive nature of acetylene, stating that the gas could be decomposed abruptly into carbon and hydrogen by contact with a detonator or by heat, the danger, however, being slight at pressures below two atmospheres, and greater as the pressure increases. The gas in England will probably be placed by legislation under the Explosives Act, with regulations preventing its use under high pressures, and especially the use of liquefied acetylene.

Exports of Electrical Apparatus from the United States.

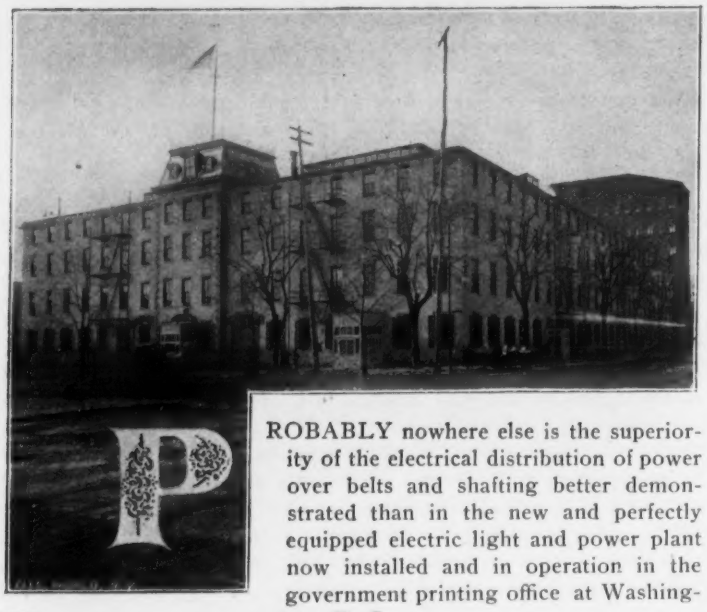
The Treasury Department of the United States Government has recently completed the compilation of statistics of the exports and imports during the last fiscal year. The figures referring to exports of electrical apparatus show that their aggregate value was $3,054,453. The countries taking the largest amounts of this machinery were as follows:

England	$437,086
Dominion of Canada	310,589
France	298,133
Mexico	284,714
Germany	240,577

Electricity for the London Underground.

The Metropolitan Railway Company, of London, England, has applied for permission to equip its lines and also those of the Metropolitan District Railway Company, with electric traction apparatus. These lines form part of the underground system of London, which has become famous for the discomfort due to steam and gases from the locomotives, and has for this reason afforded a powerful argument to the opponents of all underground systems the world over.

The Electric Plant of the Government Printing Office.—I.



PROBABLY nowhere else is the superiority of the electrical distribution of power over belts and shafting better demonstrated than in the new and perfectly equipped electric light and power plant now installed and in operation in the government printing office at Washington, D. C.

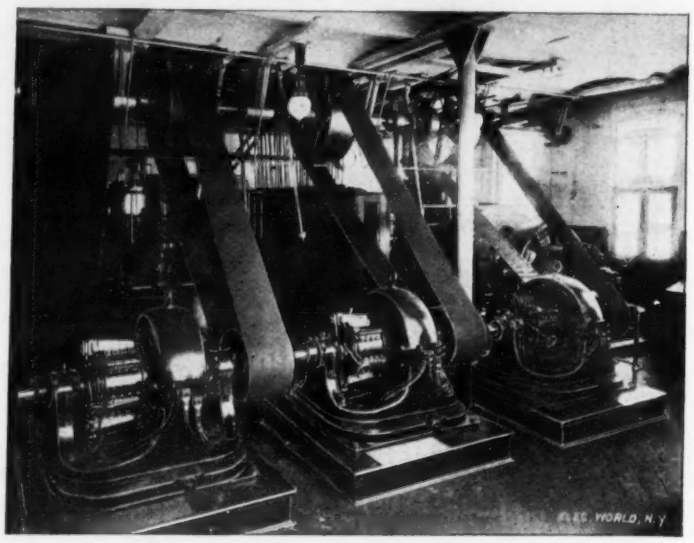
The new plant is not an experiment, but was built to meet the greatly increased demands for more power and more light, after a thorough and exhaustive trial of more than a year with a small plant had convinced the public printer of the reliability of an electrical service.

The first installation consisted of one Westinghouse 187-kw generator direct-coupled to a Westinghouse compound condensing engine rated at 250 horse-power, and three Westinghouse 60-kw generators driven from a common shaft by a 250-hp vertical compound condensing engine.

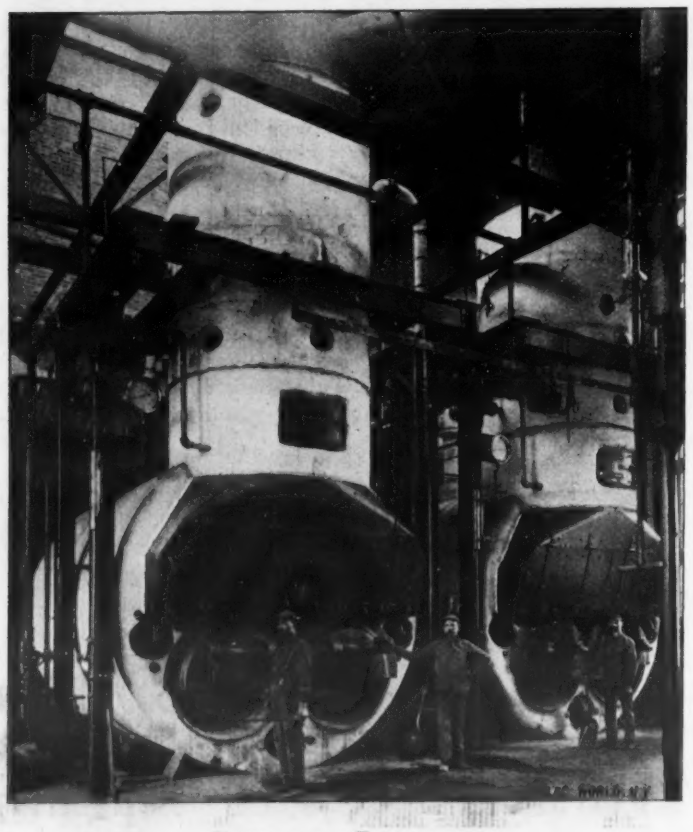
This plant was not only too small to meet the increasing demands for light and power, but it was deemed better to remove the dynamos from the printing office building. It was therefore decided to build a plant that would furnish ample power and light, and be completely isolated from the printing office buildings.

The boiler house of the new system was built with the idea that in the near future its equipment would be doubled, and that an engine and dynamo house would be built adjoining it. The two buildings are separated from the printing office by Jackson alley, which is 30 feet wide. The dynamo house has a frontage on the alley of 56 feet, and a depth of 79 feet.

The base of the smokestack is in the angle made by the difference in depth of the two buildings, the boiler house being a one-story fireproof brick building, only 56 feet square. The stack is constructed of steel plate, lined with brick, and is self-supporting. The stack foundation is a solid brick pier 22 feet square, 13 feet deep and rising 4 feet above the ground surface in a circular form, capped with a granite coping 12 inches thick. A cast-iron ring rests on this coping, and is anchored to the pier foundation by sixteen anchor bolts 13 feet long. The stack rests on this ring. The foot of the stack is a truncated cone, 17 feet in diameter at the base, 9 feet in diameter at the top, and 20 feet high. At this point the shaft of the stack begins, tapering to 7 feet 6 inches in diameter at the top, which is 156 feet above the pavement of Jackson alley. A ladder is secured to it, and leads to the top. Around the top are thirty-two 32-cp incandescent lamps. This great stack is one of the prominent landmarks of the city both by day and by night. The flue of the brick lining is 6 feet 4 inches uniform diameter to the top. The flue connection from the boilers to the stack is 6 feet 4 inches in diameter , and is located about 23 feet above the base. This stack was constructed by the Coatesville Iron Company, of Coatesville, Pa.



Belted Generators of Old Plant.



Boilers and Economizers.

There are four 300-hp steel boilers, constructed by the I. P. Morris Company, of Philadelphia. These four Scotch boilers are internally fired, and to each is attached a fuel economizer. The boilers are 12 feet in diameter by 14 feet 1 inch long, and the economizers 7 feet in diameter by 10 feet 6 inches high. Th combined heating surface of the four boilers and economizers is 14,952 square feet, with a grate surface of 210 square feet. The boilers, condensers and steam pipes are all asbestos covered. The boilers are in pairs, facing each other, and rest in cast-iron saddles, supported on brick foundations. They require no brick setting whatever, as they are constructed with internal furnaces, combustion chambers and flues.

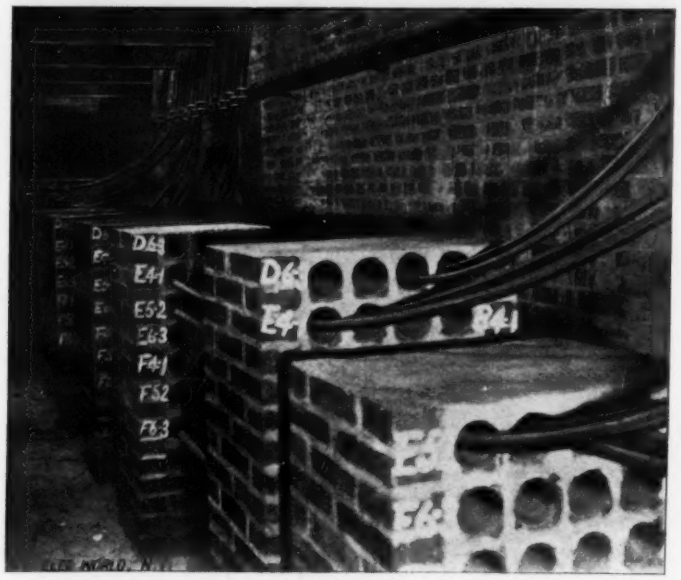
Immediately over the front end of the boilers are placed the vertical fuel economizers. These rest on a steel framework independent of the boilers. They are so connected with the boilers that the hot gases, after leaving the boiler, are forced to travel the length of the economizers three times before they escape into the chimney flue. The economizers are connected to the stack by a steel flue and branches resting on the ceiling beams over the fire room.

The feed water from the condensation of the heating system and the hot well is forced by the house pump into a tank, from which it is forced by the boiler feed pump through a heater, and introduced near the bottom of the economizer, gradually filling it, and overflowing through a copper pipe to the boiler below. At the same time another current of water from the circulating pump meets and mingles with the feed water in its passage through the economizer. The circulating pumps are placed on the boiler house floor at one side of the boilers, and are piped to pump water from the bottom of the boiler into the economizer, the object being twofold—that of

insuring a permanent water level in the economizer, and also of obtaining a rapid, but perfectly controlled, circulation of water through the boiler and economizer. The feed water, before its introduction to the economizer, is filtered through a sand filter, and heated in a feed water heater by exhaust or waste steam. The arrangement of steam mains and valves makes it possible to supply steam to any or all of the engines from the old or new boilers, or both.

The new power house, containing the engines, dynamos, switchboards, offices, etc., was designed by Mr. J. M. Stewart, architect, and built, according to his specifications, under his immediate direction. Bids were duly advertised for and submitted, and the contract was awarded to Mr. R. H. Hood, of New York. A careful examination of the building plans shows a most compact and convenient arrangement of the engines, dynamos and switchboard.

The foundations, interior cellar walls, and engine foundations are built of hard arch brick, well laid, with close joints in Portland cement. There are granite pier blocks under all columns, and all iron beams in walls. Two ring floor arches between the iron beams support the main floor of the engine room, which is concreted to the top of the beams, and brought to the proper level with terrazzo mosaic. The entire inside of the building is lined with cream-colored enameled brick for eight feet above the floor line. The roof is supported by four steel trusses, built by the Pencoid Iron Works, Philadelphia, Pa. These trusses also carry the traveling crane.



BASEMENT CONDUITS ; CAPACITY, EIGHTY CABLES.

There are three engines for generator driving. Two are of the Allis-Corliss make, the other being the 250-hp Westinghouse engine which was removed from the old power plant. The Allis-Corliss engines are of the standard horizontal cross compound direct-coupled type. The smaller one has cylinders 10 and 19 x 30, shaft 10 inches in diameter, fly wheel 12 feet in diameter, cast in two parts, and weighing 35,000 pounds. This engine drives a 125-kw multipolar Crocker-Wheeler generator. The second engine is direct-coupled to a 300-kw generator of the same make. This engine has cylinders 16 and 30 x 30, shaft 15 inches in diameter, fly wheel 16 feet in diameter, cast in two parts, and weighing 45,000 pounds. The normal speed of these engines is 150 and 100 revolutions per minute respectively, with a boiler pressure of 125 pounds per square inch at the throttle. The throttle valves are provided with by-pass valves. The engines regulate within 2 per cent. from no load to full load. All parts of the engine are automatically lubricated. They are designed to run thirty days without shutting down, and to regulate with such steadiness that the lights will not flicker perceptibly under any change of load.

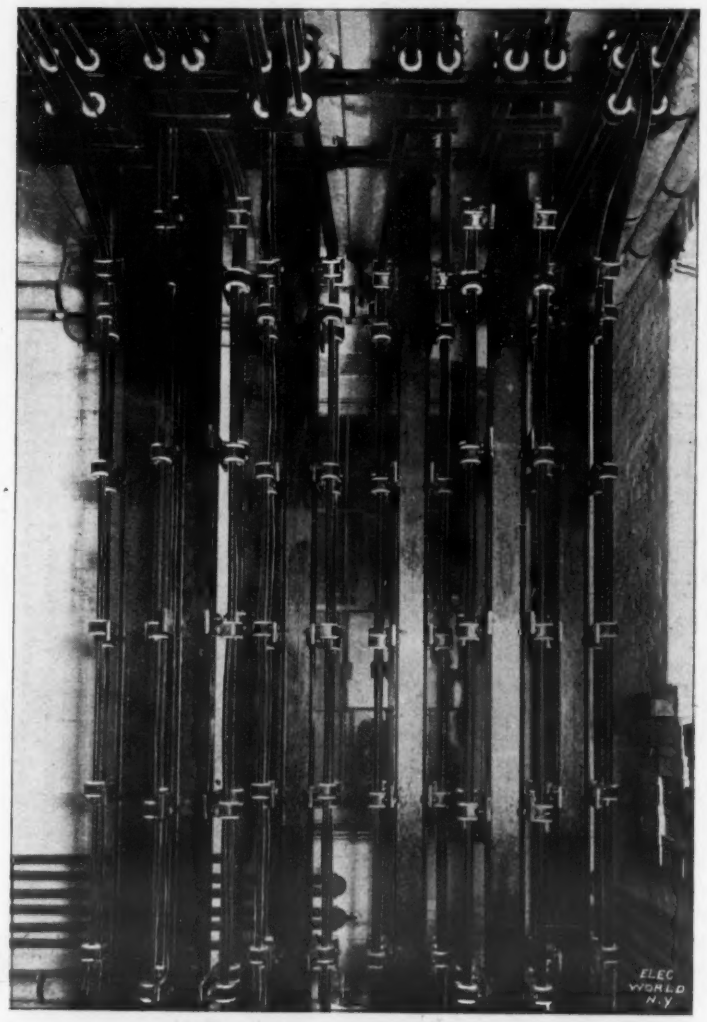
The main feeder cables lead downward into the cellar and thence through two subways under the alley, to the printing office building.

On entering the cellar they are carried through terra-cotta conduits, which are built into brick piers, as shown, and the circuits are all numbered on each pier. These piers are built about 2 feet apart to facilitate handling the heavy cables. When the cables emerge from the subway into the printing office they are carried upward on vertical I beams to the ceiling of the first floor of the printing office, thence in iron hangers secured to the ceiling, to the various distributing points. These hangers carry six cables each and are so constructed that any particular cable can be removed without in the least interfering with the others. The cables are insulated from the hangers by porcelain sleeves. Another subway contains conduits especially designed by the chief electrician. They are iron pipes about 2 inches in diameter and 4 feet long, lined with porcelain. These are laid in iron frames, holding thirty-six each, built in the masonry of the conduit on one side and above the steam pipes. The frames are tightened by setscrews so that the conduits are immovable. These frames are separated like the brick piers, admitting of free handling of the cables. They are so perfectly set and aligned that one can readily sight through them from end to end, a distance of 100 feet or more. The cables on leaving these porcelain-lined tubes enter the cellar of the printing office, across which they pass in terra-cotta conduits similar to those in the cellar under the switchboard. On emerging from these conduits they branch out in different directions for the different circuits. The hanger irons for the cables were made in the machine shops of the printing office, and put in place by the machinists, under the immediate supervision of the chief electrician.

At present there are more than 4000 16-cp incandescent lamps connected to the electric lighting mains, which number will soon be increased by about 1000 additional lamps. There are many groups of these lamps in handsome fittings, especially in the rooms of the executive department and in the different hallways and corridors. The conduits are also well lighted by incandescent lamps. In the paper rooms, and at points where safety demands it, they are fitted with wire guards.

The advantages derived from the application of motors to the machinery of this great establishment are numerous and marked.

Miles of belting, that cut off a vast amount of light, have been removed. Tons upon tons of jarring, noisy, dirt-producing shafting and pulleys have given place to nearly 150 almost noiseless electric motors. The great weight of the shafting and pulleys and the strains they produced on the floors when running necessitated the placing of a great number of wooden posts or supports throughout the buildings at a cost of fully $6000.

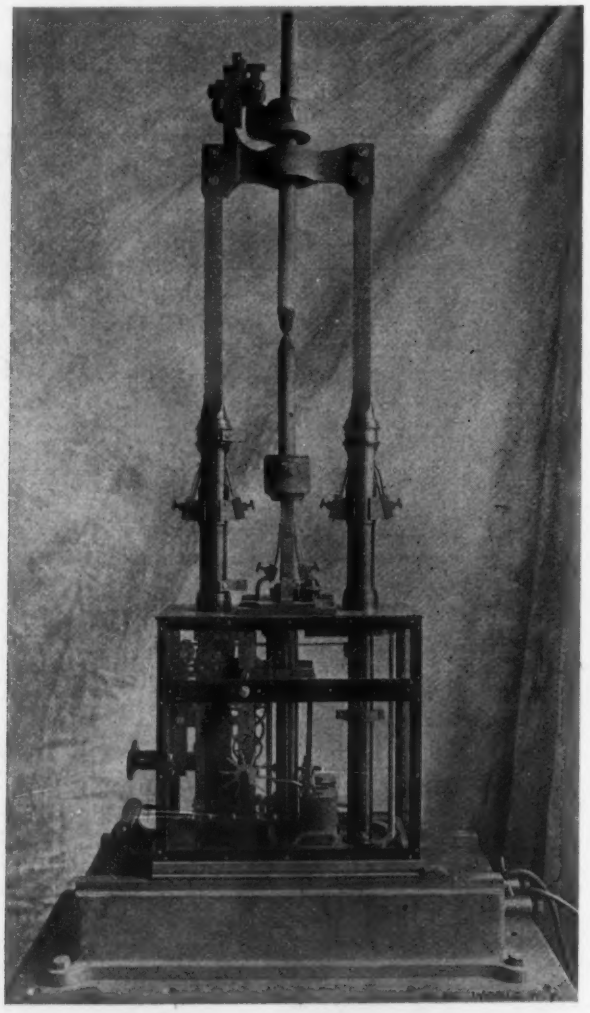


VIEW OF FEEDERS, SHOWING FASTENINGS TO VERTICAL I BEAMS.

Testing an Enormous Electric Beacon.

Some interesting tests are now being made at the general depot of the United States lighthouse establishment at Tompkinsville, Staten Island, upon a gigantic electric beacon known as the Lepaute "bivalve," or lightning lens light. The lantern consists of two lenses, each 9 feet in diameter, enclosing between them an electric arc of great power. In the central portion of each lens is a disc having two prismatic rings. Outside of this are 190 prismatic segments so arranged that the light of the arc is totally reflected in each and thrown out in a beam practically non-divergent. In this way nearly the total light of the arc is concentrated in two great beams, 9 feet in diameter, directed toward opposite points on the horizon. The whole apparatus is floated on mercury, and is driven by a powerful clockwork actuated by a spring. The period of revolution is once in 10 seconds, so that every point on the horizon receives a flash from the lens in each 5 seconds, these flashes being of about one-twelfth of a second duration. The lamp, lenses and supporting framework weigh in the neighborhood of 20 tons, and the friction is so reduced by the use of the mercury float that the whole apparatus can be easily turned by the pressure of one finger.

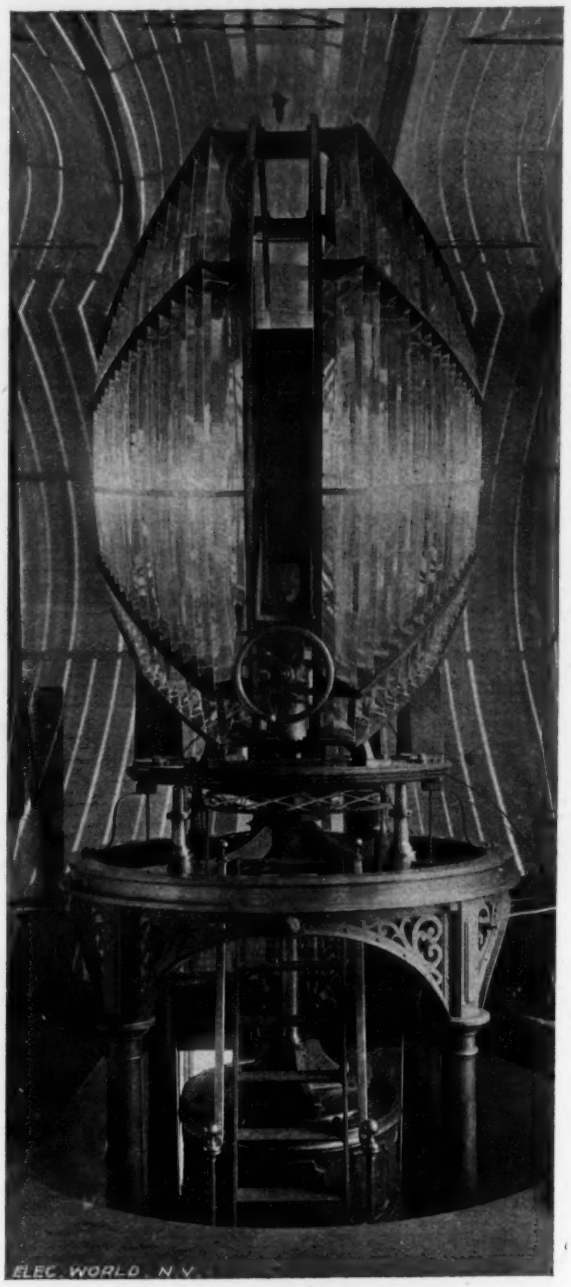
The arc lamps, of which the lens contains two, one at its focus and the other arranged to be brought into play immediately upon the failure of the first, are of a curiously complicated structure, and yet very simple in principle. The arc is struck by hand. The two carbon holders are connected together by means of a chain actuated by clockwork, the last wheel being a detent, in which is engaged a small pawl, operated by an electromagnet in shunt around the arc. When the arc lengthens out, and its resistance increases, this coil pulls away the detent and permits the clockwork to feed the carbons together. The lamps are of the most elaborate construction and finish, but it cannot be said that their complexity commends itself



Mechanism of Focusing Lamp.

to the engineering sense, certainly not of American electricians. Both lamp and lens were made by Henri Lepaute, Paris, and the whole outfit was exhibited at the World's Fair, and subsequently at Atlanta and Nashville. It was purchased by the United States Government, but its location has not yet been determined upon, though it will likely be installed at some point along the Atlantic coast, if the tests now in progress are satisfactory. There is every indication that they will fulfill every condition imposed upon the apparatus.

The lamps are arranged to carry carbons of from 15 to 60 millimetres (5/8 to 2½ inches) in diameter, and the current consumption

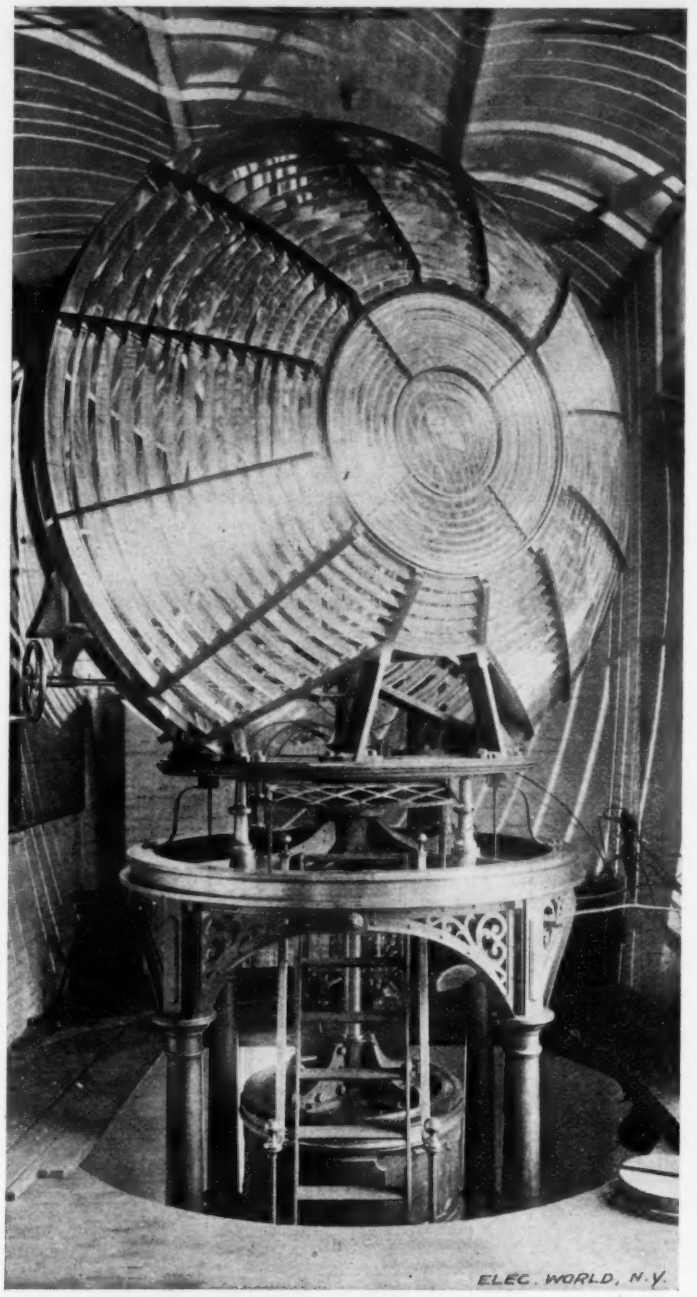


Edgewise View of Beacon Illuminated.

varies, of course, with the size of the carbon. The original apparatus was provided with an alternating current generator of French make, but it has been decided to use with the lens an alternating generator made by the General Electric Company, driven by a 25-hp Ideal engine, which takes its steam from a 25-hp Fitzgibbons boiler. The present tests are being conducted with current taken from the local lighting service, the frequency being 140 cycles per second, and the consumption with 30 millimetre carbons being about 60 amperes at 55 volts. It is estimated that the horizontal candle power of this arc without the lenses is not less than 9000. Mr. C. A. Lamy, superintendent of the lighthouse depot at Tompkinsville, estimates that the total candle power of the two beams of light is not less than 90,000,000. He arrives at this figure by adding together the candle powers of the various beams emerging from the prismatic part of the apparatus and the lenses. The beam is of enormous power, and will be easily visible at a distance of 100 miles, if mounted in a sufficiently high tower. The light can be located even when mounted in towers of ordinary height at a greater distance than

this, on account of the reflection from the clouds of the strong beams.

The accompanying illustrations give excellent ideas of the details of the lamp and lantern. When the lantern is installed in service the electric generating plant will be in duplicate throughout, to avoid any possibility of an accident. It is curious to note that the constructors of this apparatus seem to prefer clockwork for its rotation. With the alternating current supplied for the arc, there



OBLIQUE VIEW OF BEACON ILLUMINATED.

seems to be no reason whatever why the rotation of the lens should not be accomplished by means of an alternating motor, a far simpler and more reliable device than the elaborate and complicated clockwork now connected with it. The lens was set up and the tests are now being conducted under the supervision of Lieut.-Col. D. P. Heap, Corps of Engineers, U. S. A., Engineer of the Third Lighthouse District, who is ably assisted by Mr. Lamy, assistant superintendent. Colonel Heap has been experimenting for some time with various lighting agents, and has recently constructed some very interesting harbor buoys, in which acetylene is used as the illuminant.

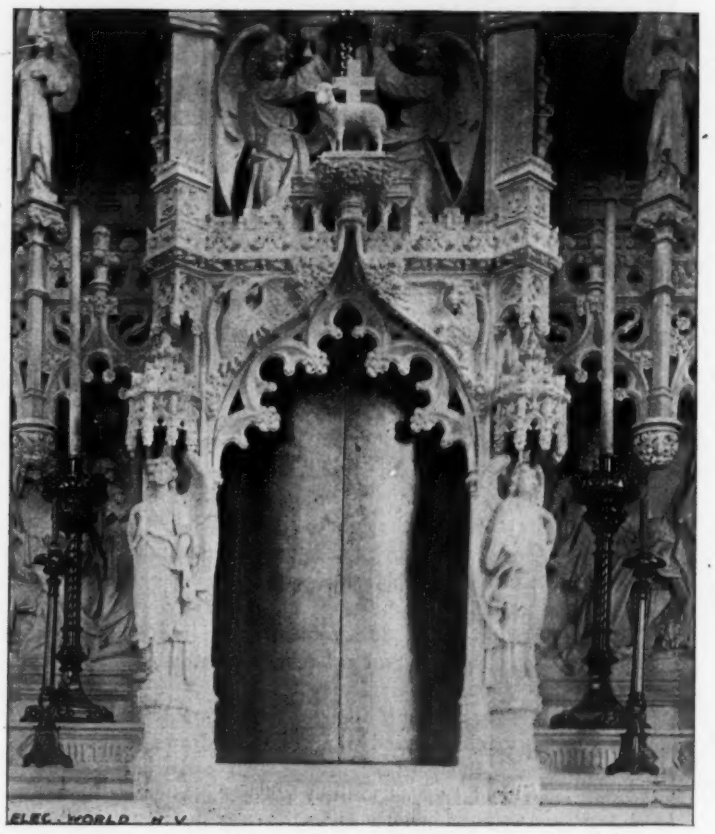
An Electric Company to Operate in South America.

The German Trans-Oceanic Electric Company has been formed in Berlin, with a capital of 10,000,000 marks, for the purpose of erecting electric lighting stations in South America. The first one will be established in Buenos Ayres.

An Electrically Operated Burglar-Proof Safe.

There has recently been erected in St. Augustine's Church, Brooklyn, N. Y., a very elaborate and handsome altar. In the centre of this altar is a costly tabernacle for the sacrament. This being constructed of solid silver and gold and studded with many large diamonds is worth many thousands of dollars, and is a source of constant worry to its caretakers. To reduce the risk of any tampering to the lowest possible limit a special and unique safe has been constructed, which is opened and closed by electric power. The construction is so effective that the whole installation is of considerable interest.

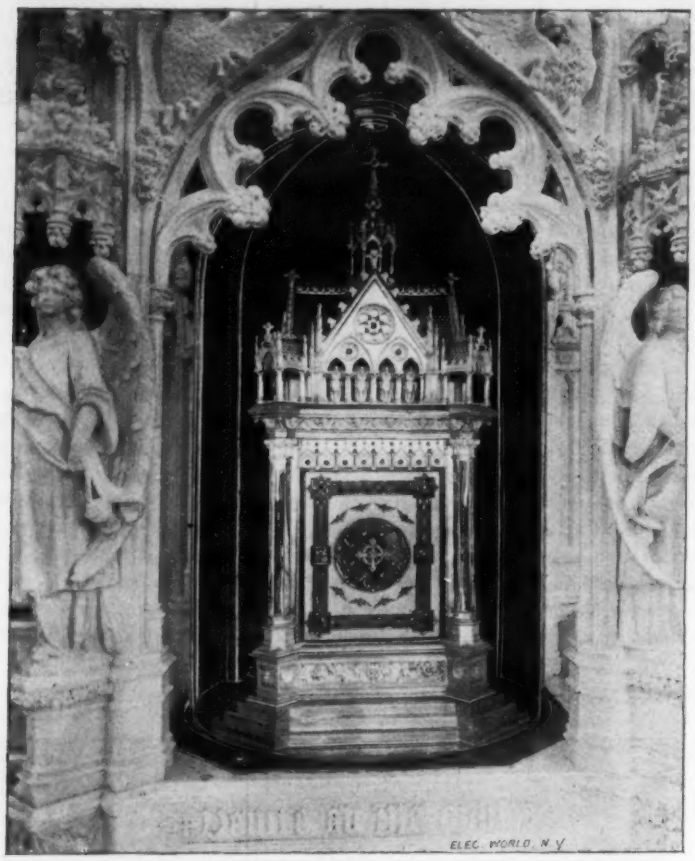
The tabernacle is placed within a richly carved marble baldacchino, the supporting columns being angels with swinging censers. In the spandrils of the arches are reliefs of the four apocalyptic figures and also the missal and the chalice. Within this baldacchino it was considered necessary to construct a burglar-proof steel safe, which should be capable of ready opening and closing on all of the three sides from which the tabernacle can be seen from the church. The problem was undertaken by Mr. E. Stancliff, and solved as follows: Around the tabernacle and inside the marble structure there is placed a solid steel safe in the shape of a vertical cylinder surmounted by a dome, the whole being about 2½ feet in diameter and approximately four feet high. This safe is made of Harveyized steel plates, 1 inch in thickness and forming three leaves, each spanning 120° about the axis of the cylinder and curving over at the top to a point at the apex of the dome. The rear leaf is stationary, the other two being capable of rotation about the axis of the cylinder, the three being firmly pinned together by a heavy bolt at their topmost points in the axis of rotation. The two side leaves meet, when closed, at the front in a tight-fitting scarf joint, and, in opening, revolve around into positions behind the stationary rear leaf. The three leaves are of slightly different diameters, and mounted on



SAFE CLOSED, PROTECTING TABERNACLE.

different centres, so that when the two side leaves are folded back they slide into positions overlapping each other and the third leaf, allowing an opening of 240°, by which the front and sides of the tabernacle can be freely seen. These leaves are covered with gold leaf, and give no visible indication of their strength and solidity. The rolling leaves being very heavy are mounted on ball and roller bearings, and are turned by solidly built worm gears, placed below the altar table, and driven by belting from a motor in the basement.

The motor is controlled by a magnetically operated switch, actuated by currents passed through push buttons beside the tabernacle, with automatic devices for cutting off the current when the doors reached their limiting positions in either direction. The starting of the motor is rendered smooth and even by the insertion of



Safe Open, Showing Tabernacle.

a rheostat, cut out by a solenoidally driven arm, retarded by a plunger in an oil chamber. The whole of the operating mechanism, including the motor, is inclosed in a steel chamber built of three-eighths inch plates, and provided with a combination lock on the door. Many parts of the mechanism are connected with a burglar alarm circuit, which runs to the nearest police station, so that tampering with any of the apparatus will immediately send in an alarm. The floor of the safe is mounted on vulcanized fibre, and separated by a very slight clearance from the steel walls about it. Any attempt to force the walls will bring the two in contact, and close the burglar alarm circuit, and any drilling of the walls will affect the same through the iron chips which will fall across the narrow gap. In this way practically perfect immunity from any risk of damage is assured.

The motor used for the purpose is a specially wound low-speed two-pole motor running at 400 revolutions, and is also used for driving a special set of blower and exhaust fans intended for the purpose of dusting the elaborately carved marble of the altars. An air blast attached to the pressure pipe is used for starting the dust, and a powerful exhaust inlet carried with the blast draws in the dust-laden air, and prevents the settling of the dust on other parts. This gives far more satisfactory work on the delicate marble carvings of the altars than the crude, old-fashioned method of the feather duster. Special electrically driven fans are also to be installed in the church for ventilating purposes.

The Bermuda-Jamaica Cable.

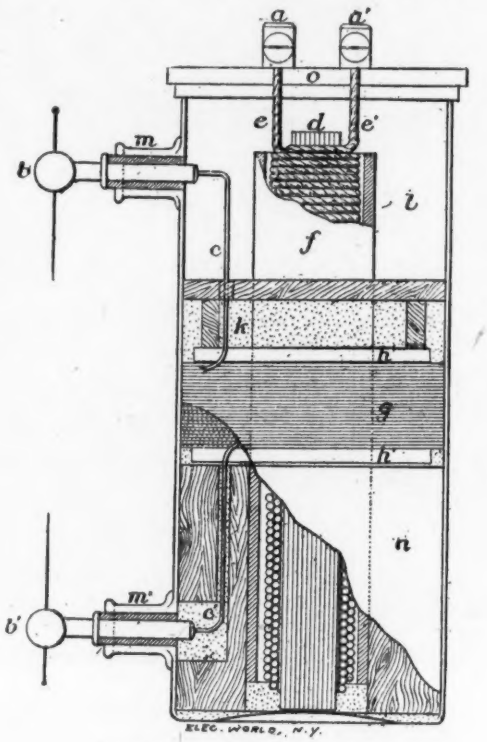
A British cable laying ship has started for Bermuda carrying in her hold the new cable to be laid from Bermuda to the West Indies, a suitable route for the same having been found by a surveying steamer. This cable is of strategic value to the British Government, as it provides a connection with the West Indies, via Halifax and Bermuda, with no stations in foreign countries.

A New Form of Induction Coil.

An improved form of transforming device for obtaining currents of high pressure has been devised by Messrs. Rochefort & Wydts, and described by them in a paper read before the Civil Engineers' Society of France, and published in a recent number of *L'Industrie Electrique*. Since the development of Röntgen rays the study of devices for obtaining high potential has taken on a new importance. The arrangement generally used is the Ruhmkorff coil, the disadvantages of which are numerous, as is well known.

For pressures of from 300,000 to 400,000 volts, the physical state of the insulation is of extreme importance. Solid dielectrics, such as glass, are easily punctured by the discharges which gradually modify the molecular condition and thereby obtain an opening. Liquid dielectrics, on the other hand, are electrified by contact with the parts of extreme difference of potential, and the molecular attractions and repulsions incident upon this static electrification cause currents to form which allow the molecules to carry their charges from one pole to the other. Viscous or semi-solid dielectrics, which have neither the porosity of the solid nor the molecular mobility of the liquid, give the most promising results. These insulators are, as a rule, hydro-carbons, which, chemically disintegrated by the electrical stresses, gradually form a fine carbon dust which seriously lowers the insulation resistance.

Messrs. Rochefort & Wydts have been able in the use of these viscous dielectrics to avoid this carbon deposition by the use of a special arrangement. In their transformer, shown in the accompanying illustration, the primary is the same as that of a Ruhmkorff coil, with a laminated iron core, *d*, on which is wound a double layer of coarse wire, *e*, leading out to binding posts, *a a*. A tube, *f*, surrounds the primary for its whole length. The secondary spool is comparatively short and is placed around the middle of the primary coil. It rests between annular disks of glass, *h*, supported by a wooden block.



Details of Induction Coil.

The two terminals of these secondary coils are attached to two posts, *b*, inserted in the openings of two glass stoppers, *m m*. The wires and leads are surrounded by the hydro-carbon insulator, as shown. The apparatus so constructed gives a discharge of 20 to 22 centimetres in length with 3.3 amperes at 6 volts applied to the primary. The secondary of a Ruhmkorff coil to give the same length of discharge would necessarily be built up of many sections connected in series and separated by insulating discs. The weight of wire in the secondary would be considerably greater, as would the energy in the primary. As the new apparatus has a low resistance in the secondary, it gives with the same pressure a greater current strength than that of the corresponding Ruhmkorff coil. As with the same pressure the intensity of the X-rays increases with the amount of current passing, the instrument is well adapted to their generation.

Digest of Current Electrical Literature American and Foreign.

by Carl Hering.

LIGHTS AND LIGHTING.

Restoring Burnt Out Lamps.—Elek. Zeit., Dec. 23.—An article calling attention to the importance of being able to renew the filaments in burnt out lamps; in Germany and Austria, for instance, about 50,000 lamps are made per day; moreover the tendency is to run them at a greater economy of current. Some of the processes which have been suggested are then briefly described; Hess in 1891 suggested opening the lamp at the tip, filling it with a liquid hydrocarbon and mending the broken filament by the deposit of carbon; it does not seem to have been satisfactory; Ponthonier removes the bulb and cuts off the filament a slight distance above the support, leaving two stumps on which new filaments are then secured, the joint being made by heating under a liquid hydrocarbon; it does not seem to have come into use either in Germany or Austria; several others suggested the use of plastic cement with which the new filaments were secured to the old supports, the cement being dried by the heat, but there seems to be little confidence in the success of any such cement; one of the objections is that the new filaments cannot be accurately adjusted in length and resistance, thus increasing the number of lamps whose voltage is too high or too low; moreover the connection between the lamp base and the lamp itself is apt to be injured by the subsequent heating; the Westinghouse stopper lamp is also briefly described, but it is thought that the use of cement for an air-tight joint is not satisfactory; it is thought that the problem of renewing lamps is still unsolved; in conclusion the process of Becher in Vienna is described and illustrated; the lamp itself has a very long neck at which it is cut open for renewal; the filaments are connected to wires and are kept in stock in this form; when a filament is to be renewed the wire terminals are connected with the stumps of those in the base of the lamp, by means of little tubes; moreover the base of the lamp is more rigidly connected to the glass; the work of renewing a lamp is said to cost 1.2 cents and requires no unusual skill.

Photometric Measurements of Alternating-Current Arc Lamps. Sohlman. *Elek. Zeit.*, Dec. 23.—A short communication calling attention to the fact that according to Wedding the mean spherical intensity of the alternating arc when cored carbons are used is appreciably smaller than that for the continuous current arcs. Earlier researches, however, have shown that when ordinary carbons or one of these and one cored carbon are used the mean intensity for the same energy is greater than with continuous currents. It is therefore very uneconomical to use cored carbons, the only reason appearing to be that it is then possible to run these lamps in series on 100 to 110-volt circuits and that the arc is more quiet. It is therefore best when a transformer can be used, to adapt the voltage to that which is best suited for the lamp, each one being independent; using one cored and one ordinary carbon a mean spherical intensity of one candle per watt can be obtained without using thinner carbons, as compared with one candle per 1.38 watt, with both carbons cored and a lower voltage. He recommends that photometric researches should be made in this direction.

Vacuum Tube Lighting. Tesla. *Elec. Rev.*, Jan. 5.—A short article on the application of vacuum tubes of high illuminating power to photography; reproductions of some very good photographs showing considerable detail are given. Some years ago he showed that such tubes, giving only half a candle, could easily be used for photographing with exposures of only a few minutes; in such experiments very interesting facts were revealed. The efficiency or other peculiarities of the tube could be easily compared by means of the photographic plate; a curious feature was that the lights and shadows came out remarkably strong, like those with flashlight exposures, but the outlines were not sharp and no detail was visible; with tubes of much greater candle power a notable improvement was reached in this respect; he believes he has not nearly reached the limit of the amount of light producible; considerable improvement was also made in the efficiency of the light produced; the reason of the great power consumption in former experiments, which may often be as much as ten times that required for an equivalent incandescent lamp, is that the tube offers an immense radiating surface, dissipating a great amount of energy without raising the temperature perceptibly; the dissipation of the energy is increased by the high temperature of the rarefied gases; calculations, based on the amount of energy consumed and the amount of material contained in the tube, indicate that such tubes are the best means for bringing a small amount of matter to a high temperature; he has succeeded in getting over some of these defects and has now made a tube whose volume is not much greater than that of an incandescent lamp for the same amount of light without the tube becoming overheated; the results are partially due to means of economically producing harmonic electrical vibrations of extreme rapidity; the fundamental principle is said to be well known, and the features of the system he promises in detail at some subsequent time. The photographs shown were taken with a tube of about 200 square inches and a frequency of about 2,000,000 per second; the illuminating power approximated about 1000 candles and the exposures ranged from two to five seconds, the distance of the objects being 4 to 5 feet. He thinks this method will be of great value in photography, partly on account of the fineness of the lines and partly because the artist will be able to adjust the conditions exactly so as to secure the best results.

POWER.

Rand Power Plant.—Lond. *Elec.*, Dec. 24.—An illustrated description of a large central power plant in this mining district of Southern Africa. There are four units of about 1000 horse-power each, direct-connected to three-phase generators; the current is transmitted at 10,000 volts.

Factory Equipment. Gunton and Lomas. Lond. *Elec. Rev.* Dec. 24.—An illustrated description of the works of the General Electric Company at Schenectady.

Water-Current Motor.—Elec. Tech., Dec. 15.—An illustrated description, with estimates of the cost, of a system of water motors for running streams; it appears to be the same one which was recently referred to in the *Digest*. The estimates show that the first cost of a steam plant and such a water motor plant are about the same, and the economy, therefore, is in the saving of the cost of the coal.

Dust Destructors. Watson. Lond. *Elec. Eng.*, Dec. 24.—A reprint of a recent paper read before a local engineeering society. It is followed by the discussion.

Electricity versus Shafting in the Machine Shop. Benjamin, *Trans. Amer. Soc. Mech. Eng.*, 1897.—A publication, in full, with the long discussion, of his paper before that society read last spring, and noticed at the time. He points out the fact that there are also conditions of more importance than mere economy of transmission; he gives tabular data of the estimated cost of the two systems in two different factories, showing that the first cost of the electrical machinery is usually greater, but that the saving in power would in most cases pay for the additional cost in one to five years; also that the question of the advantage of electricity is not alone in the efficiency of transmission, but also in the effect on the output of the product per man and per machine.

Friction Horse-Power in Factories. Benjamin. *Trans. Amer. Soc. Mech. Eng.*, 1897.—A reprint of the complete paper, with tables, which was read before that society about a year ago and noticed at the time; in it he gives some interesting tabular data for sixteen establishments; while referring chiefly to transmission by shafting, the advantages of electric transmission are also mentioned. It is followed by a long discussion, which is largely on electric transmission.

Electric Power Equipment for General Factory Purposes. Jackson. *Trans. Amer. Soc. Mach. Eng.*, 1897.—The complete paper, with a brief discussion, which was read at the spring meeting of this society and noticed at the time.

Electric Power in the Machine Shop. Mullin. *Cassier's Mag.* Jan.—A profusely illustrated article pointing out in a general way the advantages of electric power, and showing with the aid of illustrations the present status of this application in this country; the expansion in the use of electricity for driving machine tools during the past three or four years he states has been remarkable; a large number of illustrations are given of electrically driven tools, with special reference to those in the works of the General Electric and the Bullock Company; he believes that a revolution is now fairly under way in the machine shop.

Long-Distance Power Transmission. Wallace *West. Elec*, Jan. 1.—A short article on the progress during the past year, which he claims has been greater than any other branch of the electrical industry; the article is general in character; the advantages of using water power are pointed out.

Cost of Power. Eberle. *Eng. Mag.*, Jan.—An abstract of the article noticed in the *Digest*, Oct. 30.

Rating Electric Power Plants. Aldrich. *Trans. Amer. Soc. Mech. Eng.*, 1897.—The publication of his complete paper, with the discussion, which was read at the spring meeting of this society, and noticed at the time.

TRACTION.

Accumulator Traction.—Lond. *Elec. Eng.*, Dec. 24; condensed in Lond. *Elec. Rev.*, Dec. 24.—An abstract of the conclusion of the discussion of Epstein's recent paper. D. G. FitzGerald, in a communicated discussion, made some comparisons between accumulators two or three years ago and the present ones, to see the direction of improvement which would probably be made; he gives in a table some of the data on which traction by accumulators had to be based two years ago; the main characteristics of the cell were the embedded supports and the external envelope of perforated celluloid; he thinks the use of very light supports for the active material is the direction in which progress will be made. Wallace-Jones favored the single unit system, that is, he objected to splitting the cells up

into sections and grouping them in various ways; it also saves breakages in the cells if they are not divided into groups; he thought the cell of the future would have a Planté positive and a pasted negative; the life of the latter may be taken to be twice that of the positives; they cannot be regarded as lasting forever, as is sometimes claimed. SMITH did not feel very sanguine about the future of accumulator traction; he favors the use of locomotives and for this accumulators may be advantageous; he calls attention to the enormous strains on the teeth of the gearing, on account of the elasticity of the frame, and he therefore thought that chain gearing would be better; he pointed out that the resistance of drawing is very different from the resistance of self-propulsion, the former being less, a fact which is well known in the case of ships; one may be three times as great as the other; the locomotive cannot steer except by side pressure on the rails; the wind resistance is usually small and he gives some formulas illustrating this. Another speaker gave some figures concerning the tractive resistance which he found experimentally for an iron tired phaeton; the average was found to be 45 pounds per ton. DICKINSON thought it had yet to be demonstrated that accumulators would do what is required in traction work. EPSTEIN, in his final reply, said among other things, that the unsatisfactory results at Birmingham, which were so frequently referred to in the discussion, were not a criterion of the battery principle.

Efficiency of Railway Motors. FISCHINGER. *Elek. Zeit.*, Dec. 23.—A description of tests which he made with motors designed by him, and showing that railway motors are now built which have a much higher efficiency than those recently mentioned in an article by Ross. The efficiency tests were made in connection with the gear wheel reduction, and also included tests of the lubricants used. The results are given in tables and curves, the tests having been made with and without gear wheels, the reduction of which was about 1 to 5, the pinion being of hardened steel with fifteen teeth, and the spur wheel of cast steel with seventy-six teeth. He shows how for every magnetization, or speed curve, a curve of the pull can be constructed; one of his figures shows that the difference in the excitation at greater loads produces but small differences in the speed; also that the efficiency at full load and complete magnetization is much lower than at half excitation, as the motors were constructed to have a great starting effect with a very high excitation; he claims that with these motors it is not necessary to keep operating the controller in order to get the best results. In the tests of the lubricating material he used grease and valvoline oil, and found that with the former there is in general greater loss than with the latter for greater loads, but for the lower loads the loss is greater with the oil; he believes the conclusion can be drawn that the oil has the advantage over the grease, especially because the wear on the teeth would be less.

Clontarf.—Lond. *Elec.* and *Elec. Rev.*, Dec. 24.—An illustrated description of this line near Dublin, which has recently been equipped; it comprises about 3 miles of double track, and it appears that the American system is used.

Prague.—Zeit. fuer Elek., Dec. 15.—The second portion, and apparently the conclusion, of the very long illustrated article describing the electric railroads in that city.

Possibilities and Limitations of Electric Traction. SPRAGUE. *Eng. Mag.*, Jan.—An article on the present accomplishments and future possibilities of electric traction. He subdivides transportation lines into different groups, and refers to each separately, showing that electric traction may be used to advantage in some cases, but not in others; for street cars it may be used almost exclusively; for elevated railroads the end of the steam locomotive is near at hand; for underground systems there is no longer room for argument; for suburban lines on which steam is generally used difficulties are encountered; on these there are two methods of using the motors, either on the axles or as separate locomotives; he recommends the former, which he considers an ideal system, and with what he calls the individualization of equipment of passenger cars it is now possible and advisable; a high speed service with this system is practical and commercial; he considers this system as a radical departure from all previous practice, and believes it has an important future; he thinks the displacement of all locomotives, steam or electrical, seems to be assured by his own multiple unit system of control; Lundie, of the Illinois Central Railroad, showed that any given schedule can be made most economical by obtaining a very high rate of acceleration; there is a rate of acceleration coincident with the minimum cost of operation; the shortening of schedule time is much more important than any possible saving of power. The consideration of trunk railway service is reserved for the next issue of that journal.

Electric Railway. ARNOLD. *West. Elec.*, Jan. 1.—A short article on the electric railway during the past and coming year. The most important development has been the application of the third-rail system on steam railroad service; all the elevated railroads in Chicago have now adopted electricity, and he believes that during the present year a number of suburban steam lines will be equipped electrically; an extended application of th storage battery is another one of the developments; the Chicago accumulator line has now been running for over six months with successful results, as far as public service and economy in operation are concerned, but the cost of operation is not made public; many applications of the storage battery will be made during the coming year, as an auxiliary in the power stations; he thinks it reasonable to expect the development of the three-phase current at high voltage for long distance country lines, the current being transformed down to a direct current; the details for such a system involving 10 miles, driven by one central station, are ready for the construction work, and careful estimates show that the cost of construction and operation would be less than for the present trolley system at 600 volts; storage battery sub-stations are used as equalizers. The underground conduit system has proven its usefulness, and the coming year will demonstrate whether it or the storage battery system is to be the victor.

Condition of the Horseless Carriage Industry. CORRIGAN. *West. Elec.*, Jan. 1.—A short article calling attention to the effect of good roads, and the need of more plants for charging the electric carriages; carriages now exist that are run forty to sixty miles a day with one charging with batteries of about one-third the weight and bulk of anything known heretofore.

Rapid Transit in New York. MARSHALL. *West. Elec.*, Jan. 1; reprinted from the New York *Sun.*—A short article of a general character giving a history of the work of the Rapid Transit Commission, calling attention to the risks, and claiming that a total failure of the scheme in to be provided for, and that the losses should be assumed by the contractors.

Third-Rail System.—Elec. Age, Jan. 1.—An illustrated description of the Murphy system in which the contact bar or rail is in sections which are switched into circuit as the car moves over them; a storage battery is carried on the car for operating the switches.

Heilmann Locomotive.—West. Elec., Jan. 1.—Extracts, with some of the illustrations, including the portrait of Heilmann, of the article noticed in the *Digest*, Dec. 18, from *L'Energie Elec.*

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Central Stations. FELDMANN. *Elek. Zeit.*, Dec. 23.—The beginning of a reprint of a recent lecture in which he discusses the various factors which affect the success of central stations from a financial standpoint. He discusses these under the headings of the efficiencies, the load factor and the methods of charging. Under the heading of efficiencies he gives diagrams similar to those published some time ago in an English paper, consisting of rectangles with diagonal lines indicating the efficiencies of each part of the process of converting the energy of coal into lights; in the case of the load factor he prefers a term which might be translated as the utilization relation and the utilization factor, the former corresponding to the term load-factor and the latter being the relation of the time during which the plant is utilized in hours to the total number of hours in that period; the time during which it is utilized is calculated by dividing the amount of energy consumed in kw hours, by the maximum possible number of kw hours. He gives a formula showing the relation between this factor, the load factor and the efficiency; this relation is that the load factor is equal to the utilization factor divided by one minus the efficiency plus the utilization factor; the formula is only approximately correct; a small table of values is calculated; another takes into consideration the other factors besides the consumption of coal, and gives the charge which would have to be made per hectowatt hour (10 hectowatt hours equal one kilowatt hour); this shows that if the mean time is only 500 hours, the price would have to be twenty cents per kw hour when the consumption for lighting is the greater; when that for power is the greater, and the number of hours for every hectowatt connected with the circuit is 3000, the mean price can be reduced to 3.7 cents per kw hour, and for power purposes alone at 6000 hours a year, as for instance for electro-chemical purposes, the price could be reduced to about half of the latter.

Malaga.—Lond. *Lightning*, Dec. 23.—A brief, illustrated description of the English central station in that city in Spain, the total capacity of which at present is 330 kilowatts, and is soon to be more than doubled; the principle of free wiring was adopted, with the result that the station started with a paying load at once, and earned a dividend in its first year; the alternating curent system with sub-stations under the streets is used.

Hamburg.—Zeit. f. Beleucht., Dec. 20.—A long extract from the report on the operation of this station for the year ending in July.

Central Station Advancement. FERGUSON. *West. Elec.*, Jan. 1.—A short article on the progress during the past year. Much has been done in their development, due to radical changes in the engineering methods and to the gradual evolution of the apparatus; the development of the electric elevator has done much for the central station business; he thinks that the installation of isolated plants within a territory supplied by a central station is a mistake; experience in Chicago he claims has demonstrated that the day of the isolated plant in such district is passed; the small enclosed arc lamp operating at 3 amperes has more than met the competition of the Welsbach light; he advocates connecting arc lights to low-tension stations, as the load is a favorable one; the most radical change in recent advancement is the proposed abandonment of all steam generating stations in various parts of the city (probably referring to Chicago) and consolidating the steam plant in one or two large places; there has been a tendency toward lower prices for current and a revision of the methods of charging; a very prosperous future is indicated for central station companies in the large cities.

Isolated Plants. PIERCE. *West. Elec.*, Jan. 1.—A short article in which he assumes the isolated plant to be a firmly established factor and gives a few of the reasons for progress made during the last year. The antagonism between central stations and isolated plants is only imaginary, as there is a broad and profitable field for

both; the chief reasons why an isolated plant is in many cases more economical than buying the current are that many of these plants have as great a capacity as central stations which pay; the load factor is often better; there is often a great saving due to the use of exhaust steam for heating; in many cases little additional labor is required, as the machinery is already installed; the plant usually costs less per kilowatt, as no capital is invested in distribution circuits; the depreciation ought to be, and usually is, less. He thinks an increase in isolated plants can be expected; a most promising field is in operating factories by direct-coupled motors.

Storage Battery Applications. CLARK. *West. Elec.*, Jan. 1.—A short article on the future of the storage battery business. After enumerating the well-known advantages of storage batteries, he calls attention to their use in the future when storage becomes necessary to utilize the whole of a water power; another opening is in the installation of batteries on the premises of large users, a business which is already being exploited successfully in connection with a station in the East; reliability and endurance are the chief requisites, as distinguished from the reduction of the weight; he thinks there is more than a probability of a profit in storage battery traction as compared with the underground conduit system; train lighting by batteries will be universally used.

Electrical Construction and Inspection. MERRILL. *West. Elec.*, Jan. 1.—A very brief article on a review of the progress in this direction during the past year, and calling attention to the great importance of the universal adoption of the National Electric Company's standard specifications; a uniformity in the rules of the inspection departments means very much to all interests involved and the past year marks the greatest step in this direction. The fire losses during the past year have exceeded the year before, as might be expected with the extension of electrical work; but electricity has been responsible for only about one-forty-fifth of the total annual fire loss.

Chicago.—West. Elec., Jan. 1.—An illustrated description of the three-phase transmission plant recently started, connecting two stations of the Chicago Edison Company, as it is intended to concenthe steam generating plant for the entire city and suburbs in the down-town stations located near the river and to abandon the steam generating plants at the other stations; the present arrangement is only temporary, and consists of a 250-kw rotary transformer converting the direct current into three-phase alternating current; the voltage is raised to 2300.

ELECTRO-PHYSICS AND MAGNETISM.

Impenetrability of Metallic Enclosures to Electric Waves. RIGHI. *L'Eclairage Elec.*, Dec. 11.—An abstract of a paper from the Italian. In connection with the Marconi system of telegraphy it has been stated that electromagnetic waves will act on the coherer even when the latter is enclosed in a metallic box; this is contrary to the results obtained by Lodge, and would affect such a system of telegraphy, besides endangering the explosion of materials enclosed in metal, by producing a spark; he therefore made researches in this direction and found that when the precautions are taken to completely enclose the coherer in a metallic envelope the waves do not penetrate, but an interruption in the continuity of the envelope, even in the form of only a very small opening, is sufficient to enable a very energetic action to take place in the interior; his results agree with those of Lodge.

Spherical Conducting Shell. WHITEHEAD. *Proc. Lond. Phys. Soc.*, Nov.—A reprint of a Physical Society paper of a mathematical nature; the paper was noticed in the *Digest*, Sept. 4.

Dielectrics and Temperature. HASENOEHRL. *Proc. Lond. Phys. Soc.*, Nov.—Abstracted briefly from the *Wien. Ber.*, 106, p. 69.—He applies his recently described method for measuring the change of specific inductive capacity of liquids to glass, ebonite, paraffin and quartz.

Atmospheric Electricity. CANCANI. *L'Eclairage Elec.*, Dec. 11.—An abstract of a paper from the Italian giving the results of measurements made in the Royal Observatory at Rocca di Papa.

Hysteresis. KLEMENCIC. *Proc. Lond. Phys. Soc.*, Nov.; noticed briefly from the *Wien. Ber.*, 106, p. 236.—An abstract of the article noticed in the *Digest*, Nov. 20.

Rotating Magnetic Field. COLARD. *Proc. Lond. Phys. Soc.*, Nov.—An abstract of the recent articles noticed in the *Digest*, Sept. 25, Oct. 16.

Electrolysis of Gases. WIEDEMANN and SCHMIDT. *Proc. Lond. Phys. Soc.*, Nov.—An abstract of the article noticed in the *Digest*, Sept. 4; he used a battery of 1000 accumulators, and found that there was no electrolysis of gases in the Faraday sense.

Effect of Lightning Discharges on Coherers. WEILER. *Elek. Zeit.*, Dec. 23.—A short communication referring to the recent one by Englisch (see *Digest*, Dec. 18), in which it was claimed that no effect was noticed on an electroscope, which was really more sensitive than the coherer. The present writer calls attention to a modification of the electroscope suggested by Lodge in his work on Hertz's researches; the electroscope then becomes very sensitive to the slightest discharge; it consists essentially in placing a highly polished point of a screw "almost infinitely" near to the knob of the electroscope; the electricity of the charged gold leaves then endeavors to pass over, and the feeblest electric waves bring about this equalization or at least a movement of the leaves.

Conductivity of Iron Oxides and Sulphides. ABT. The notice of this article in the *Digest*, Jan. 1, on page 35 contained a typographical error; the word "magnetic" in the next to the last line of that paragraph should read "magnetite."

Electro-Capillary Phenomena. LUGGINS. *Zeit. f. Elektrochemie*, Dec. 20.—A reprint of a recent lecture describing some demonstration experiments which he believes to be new.

Voltage of Spark Discharges. TROWBRIDGE. *Am. Jour. of Sc.*, Jan.—A short article on E. M. F., in which he gives the results of experiments made with his improved Planté rheostatic machine with sixty condensers and a 20,000-volt accumulator, thus giving 1,200,000 volts; with this he investigated the conditions necessary to produce a spark of great body, 48 to 50 inches in length; the length corresponding to the latter voltage is 48 inches. E. Thomson, with transformers sparking 50 to 60 inches, estimated that the voltage necessary to produce a spark of 80 cm was 500,000; the present writer believes this is nearer the truth than the 100,000 claimed by Heydweiler. The results show that Lord Kelvin's conjecture that the electrostatic force necessary to produce a spark in air "remains sensibly constant for all distances" beyond the limit he described is correct, for when the length of spark is plotted as abscissas and the corresponding voltages as ordinates a straight line is obtained. The rheostatic machine is much more efficient than the transformers for such high voltages; with the former one-third of a horse-power will produce the effects which heretofore required 30 to 40 horse-power; the method of charging and discharging the condensers was to use lever arms instead of rotary cylinders, thus securing greater uniformity of action. He also tried the discharge through Crookes tubes, one of which was exhausted so that an 8-inch spark preferred to pass through the air; the discharge produced by the machine passed readily through the tube, producing brilliant X-rays and the degree of rarefaction of the tube was not sensibly affected by single discharges. The results so far obtained show that the length of the spark is proportional to the voltage, and that rarefied spaces hitherto considered to have too high a vacuum to conduct electricity cease to act like such a vacuum to these very high voltages.

X-Rays and Mineral Phosphorescence. BURBANK. *Am. Jour. of Sc.*, Jan.—A short article describing experiments with fluorescent minerals under the action of these rays. Fluorite phosphoresces with a bluish white light which continues for a very long time afterwards; it is sometimes used below the photographic plate in radiography to increase the effect, but it unfortunately fogs the plate and blurs the outlines. Many minerals were tried, and more than two-thirds were found to phosphoresce, those containing calcium being the most susceptible, and in general those containing the ores of the metals being non-phosphorescent; with calcite the effect of heat is to greatly brighten the light emitted; with other crystals heat sometimes increased, sometimes diminished, and in several cases did not affect the light.

Phosphorescence by Electrification. TROWBRIDGE and BURBANK *Am. Jour. of Sc.*, Jan.—A short article, in which they endeavor to verify by means of phosphorescence the statements that X-rays communicate an electric charge to bodies. They believe that it is not inconsistent with the electromagnetic theory of light to conclude that the phosphorescence excited by sunlight or daylight is due to "an electrical condition which can be dissipated by heat;" phosphorescence may be an evidence of the electrical stresses which produce the phenomena of ultra violet light.

Röntgen-Ray Notes. ROLLINS. *Elec. Rev.*, Jan. 5.—A continuation of his notes. In order to see through greater thicknesses, and yet have marked contrast, he recommends raising the amperage, thus keeping the wave length unchanged, but increasing the amount of light, which does not change the relative transparency very much; he endeavors to show why there is a change in the relative transparencies; for greater details in the bones waves of shorter wave lengths are required. He also found no reason why a brass anode should not be used instead of the more expensive platinum. He found that the burning from vacuum tubes not generating X-rays may be severe, the tube being exhausted to such a degree that no Röntgen light could be produced with the voltage used.

Magnetic Shielding.—El'ty, Jan. 5.—A reprint of the article noticed in the *Digest*, Jan. 8.

ELECTRO-CHEMISTRY AND BATTERIES.

Plated Aluminum. SATTLER. *Zeit. fuer Elek.*, Dec. 15.—An abstract of a recent lecture on aluminum in general, in which he states that a German named Wachwitz is now able to plate aluminum with copper with very satisfactory results; many objections to the use of aluminum are thereby overcome, and it is claimed that this metal when plated is the best of all the ordinary metals; the copper is deposited only in a very thin coating, so that its weight is not significant; the union of the two metals is so perfect that the plates may be rolled or stretched without the copper peeling off; wires so covered are easily plated with silver or gold; it is claimed that a large company is being formed to use this process; the process itself is not described.

Zinc from Its Ores. HOEPFNER. *Elec. Tech.*, Dec. 15.—A short article on his process in which he claims that a good coating of zinc is obtained without any mechanical pressure in a very simple way. An electrolytic process would not be commercial unless it involved the production of a by-product of value; he therefore uses chloride of zinc, the chlorine obtained being of value; the zinc is of the greatest purity and consistency; the cathodes appear to be discs on a horizontal shaft, on which they revolve, the smaller half of the plate

being in the liquid, and the rest above; no oxidation of the zinc takes place in the part exposed to the air; the current density is high; the electrolyte must first be freed of the electro-negative metals. The process itself is not described.

Separation of Antimony and Tin. Waller. *Zeit. f. Elektrochemie*, Dec. 20.—A reply to the recent criticism of Ost (see *Digest*, Jan. 1).

Conductivity of Solutions. Laszczynski and Gorski. *Zeit. f. Elektrochemie*, Dec. 20.—Descriptions of some researches concerning the measurement of the conductivity of the solutions of some salts in pyridin.

Accumulator Plates.—Zeit. f. Elektrochemie, Dec. 20.—Illustrated descriptions of several methods of making plates, taken from German patent specifications; also a method of charging accumulators with alternating currents, in which two vibrating contact makers are used.

Calcium Carbide.—Prog. Age, Jan. 1.—Some notes from the *Chemical Trade Journal*, Nov. 13, concerning the Neuhausen and the Bitterfeld plants; the former is steadily enlarging its capacity, and now sells the carbide of a standard quality capable of reducing 4.8 to 5.1 cubic feet of acetylene gas per pound, the charges for the carbide, without packing, being 5.24 cents per pound for less than a ton, and 3.93 cents per pound in lots of five tons or over; including the packing in sealed drums, the price is about $15.73 per long ton of carbide, and this is believed to be the minimum price at which this material can now be obtained.

Cyanide Process of Gold Extraction. Tonge. *Eng. Mag.*, Jan.—A well illustrated article in which he gives a brief history of this process, followed by a list of such plants in operation in this country, accompanied by brief illustrated descriptions of a number of them; in the conclusion he emphasizes the great importance of putting such plants in charge of one who is perfectly competent.

Osmotic Pressure and Electrolytic Dissociation. Compton. *Am. Jour. of Sc.*, Jan.—A long abstract of an article from the *Journal of the Chemical Society*, Aug. He shows that the assumption made by Van't Hoff, that the liquid solvent and its vapor have the same molecular mass, is not justifiable; the law of osmotic pressure does not hold in its original form when either the solvent or the dissolved compound are associated.

Surface Travel on Electrolytes. Fiske and Collins. *Am. Jour. of Sc.*, Jan.—Descriptions of experiments to investigate the availability of Ohm's law for electrolytes when in circuit with alternating currents, the experiments being made with currents of much higher frequencies than those formerly used. The electrolyte was a saturated solution of sulphate of copper; the resistance was measured by a Kohlrausch bridge and a photograph of the spark was taken with the solution in series with the spark gap, the number of half oscillations being plotted against the ohmic resistance; the solution was then replaced by manganin wires and the operation repeated, the curves obtained being compared; these are reproduced, and show that the wires exhibit no surface travel; the evidence is in favor of surface travel in the electrolyte; with a still higher frequency they think this can be completely established.

Electrolytic Decomposition of Aqueous Solutions.—Am. Jour. of Sc., Jan.—A brief extract of a recent lecture by Nernst from the *Ber. Berl. Chem. Ges.*, July, in which he considers the chemical mechanism of the electrolytic decomposition of aqueous solutions.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Measurement of Low Resistances. Housman. Lond. *Elec.*, Dec. 24.—A communication describing what he considers a simple and accurate method of measuring very low resistances in two stages, by means of an intermediate resistance, a method which is feasible and rapid; he has used it during the last three years; it implies the use of the Wheatstone bridge and a d'Arsonval galvanometer having a sensitiveness of about one millimeter per microvolt; the resistances are measured between potential points on the bar. The method, which is illustrated and described, does not admit of being described in abstract; the secondary standard is about 9 feet of No. 18 manganin wire adjusted to one ohm and capable of carrying 2 amperes for a few seconds; it is connected to the low resistance to be measured by a strip of manganin wire of about 0.01 ohm, capable of carrying 50 amperes; the first step of the process is to measure the ratio of the low-resistance manganin strip plus the resistance to be measured, to the manganin ohm; the second stage is to determine the ratio of the resistance to be measured to the sum of the resistances of the low-resistance strip and the resistance to be measured; the resistances of the connections are eliminated in a way which he describes; no contact included in the first measurement is altered in the second; the result is then calculated from these two measurements; no difficulties are involved. There is no reason why resistances as low as a hundred-thousandth of an ohm should not be measured to at least one part in 1000.

Temperature Compensation of Standard Cells. Campbell. Lond. *Elec. Eng.*, Dec. 17; *Elec.* and *Elec. Rev.*, Dec. 24.—An abstract of a Physical Society paper. His method has already been described; in the present paper he describes the apparatus. The first arrangement keeps the difference of potential between two points of a conducting system constant at all room temperatures, or it can be made to modify the voltage of standard cells, so as to give some convenient whole number; this resembles a Wheatstone bridge with the galvanometer branch removed; one pair of arms is of copper and the other of manganin; the auxiliary voltage is supplied by Leclanché cells at the two galvanometer points of the bridge, and applied in series with the standard cell. In an alternative method only one of the four arms is made of copper; in a second arrangement two wires are connected in parallel, one of manganin and the other partly of copper and partly of manganin, a constant current being applied at their ends; the resistances are chosen so as to give a constant voltage at the ends of the manganin portion, which can be maintained to within 1 in 2000. The system is symmetrical and the thermal currents are consequently neutralized.

Measuring a Capacity by Means of a Balance. Lang. *L'Eclairage Elec.*, Dec. 18; abstracted briefly from the *Wied. Ann.*, 61, p. 800.—A brief abstract, with the formulas, of the article noticed in the *Digest*, Nov. 16 and Nov. 6.

Determining Hysteresis in Straight Iron Strips. Fleming. *Proc. Lond. Phys. Soc.*, Nov.—A reprint of his Physical Society paper, which was noticed in the *Digest*, July 3 and Oct. 2.

Accuracy of Motor Meters. Perry. Lond. *Elec.*, Dec. 24.—There is a belief that the ordinary motor meter does not record correctly if the current alters considerably, a question which comes up in connection with elevators and railways. In this short communication he calls attention to some curves obtained by Holden, of the Thomson-Houston Company, which show that there is no such error; the author then shows that it may easily be proved mathematically that the meter will make correct records.

Meter. Hummel system. *Zeit. f. Beleucht.*, Dec. 20.—An illustrated description of his alternating current meter which contains a motor; it is a watt hour meter for single phase currents based on the Ferraris principle.

Localizing Breaks in Submarine Cables. Murphy. Lond. *Elec.*, Dec. 24.—A communication in which he praises very highly the recently described method of Schaefer, considering it the best method of break testing which now exists; but he does not agree with him on the theoretical inferences to be drawn, and this he discusses.

Transmission Dynamometer. Dalby. Lond. *Elec. Eng.*, Dec 24.—An abstract of a paper read before the Institution of Civil Engineers, describing a new device for measuring the deformation of the spring in transmission dynamometers, in which this is used to measure the work transmitted.

Transmission Dynamometer. Bedell. *Trans. Amer. Soc. Mech. Eng.*, 1897.—The publication in full, with the brief discussion of his paper read before this society last spring, and noticed at that time.

Harmonic Analyzer. Michelson and Stratton. *Am. Jour. of Sc.*, Jan.—An illustrated description of a simple and fairly accurate machine which will save considerable time and labor in the computations of the resultants of a large number of simple harmonic motions.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Submarine Cables of the World.—Elek. Zeit., Dec. 23.—Tabular statistics giving the number and length of cables for 1894 and 1897 divided among the different countries and the different companies, therefore showing the growth in the last three years; it appears to be based on official information. There is also an editorial reference. The total number of cables is 1459 and the length 301,930 km; the yearly increase during the last three years is about the same as the average during the past thirty years; the largest portion of these belong to private companies, who own 265,106 km, while those belonging to governments have a length of 36,824 km, of which Norway has the most, namely, 325, but the total length is only 600 km; in length France leads with 9325 km; of the thirty private companies the Eastern Telegraph Company has the greatest length, namely, 48,087 km; a number of the older cables have become useless; it is of interest to notice that the first true submarine telegraph cable, which was laid in September, 1851, from England to France, a distance of 41 km, is still in use to-day, and is in a good condition, while many others laid since then are useless some having failed within a few weeks and some within a few days after they were laid; of those laid up to 1859 there are still eleven in use; of those laid in the 60's there are still sixty-six in use.

Telephone Induction Coil.—Elek. Zeit., Dec. 23.—A brief illustrated description of the new form adapted by the Wurtemburg Telegraph Department; the recent tests of Reding (see *Digest*, Jan. 1), appear to have been made with the older form. The new form is made with a flat coil and a core similar to that used in transformers and made of stampings resembling the letter E; the advantage over the former ring form is that a coil injured by lightning is very easily replaced; this new form has been in use for the past three years; formerly paper insulation was used between the iron laminations, but now the oxidation and a coating of shellac are found to be sufficient.

Multiple Telephone Systems.—Zeit. fuer Elek., Dec. 15.—The conclusion of the long serial noticed in the *Digest*, Jan. 1.

Telegraph and Telephone Statistics.—The attention of those interested in such statistics is again called to the *Journal Telegraphique*, published monthly in Berne in the French language, which contains very full and detailed statistical matter obtained from official sources, the journal being published by the International Bureau of Telegraphy; the statistics, which appear in almost every number, will not be again referred to in the *Digest;* they are no doubt the best and most complete published.

Independent Telephone Movement. Thomas. *West. Elec.*, Jan. 1.—A review of the independent movement during the past year, and its prospects during the present one. The popularity of the move-

ment is no longer doubted, and the past year has shown that a better service can be furnished at half the cost than before this movement started; the past year marks the beginning of the movement in the larger cities; St. Louis will open the largest independent exchange in the United States this year. More than $25,000,000 is now invested in independent telephony, and there are about 1100 exchanges in operation or under construction. The opposition has been spurred to new energy; during the coming year the independent movement will meet even greater opposition, but on account of its increased strength this will be more easily met, and developments will be faster; it matters but little whether the patent litigation on the art of telephony will end this year or not.

The Telephone in 1897. HIBBARD. *West. Elec.*, Jan. 1.—A brief review of the past year. The year has been of special interest in this field, there having been more concentration and combination; the primary batteries at the subscriber's end are dispensed with, as well as the magnetic call; the signaling devices have been greatly perfected; New York is at the head of the list of exchanges, having nearly 20,000 telephones in operation, Chicago having 15,000, but the number of daily calls is greater than in any exchange in the world; the average length of wire in the latter city is 3.5 miles for each connection and the daily number of calls is about 220,000; more telephones have been installed during the past year than ever before.

Telegraph in 1897.—West. Elec., Jan. 1.—A brief article on the past year, consisting of extracts from the reports of the Western Union Company, which company transacts about three-quarters of the commercial telegraphy in this country.

History of the Telephone. MAYNARD. *Elec. Rev.*, Jan. 5.—A review of the pioneer work with the telephone.

Phonoplex Telegraph. VAN ORDEN. *Telegraph Age*, Jan. 1.—A brief illustrated description of the Edison phonoplex system, which is now being introduced by the Western Union and the Postal Telegraph Companies. It is an application of the principle of induction, and is not new; it is claimed to be the only well-known method of transforming a single Morse wire into a duplex circuit, on which it is possible to obtain two separate sendings from one terminal or two separate receivings, thus forming an excellent emergency system, especially valuable for railroad service.

MISCELLANEOUS.

Ozonizer. ANDREOLI. Lond. *Elec. Rev.*, Dec. 17.—A communication quoting references to show that Beanes is not the inventor of the flat-plate ozonizer; the one that bears the name of Beanes was devised by Du Moncel more than ten years before Beanes introduced it. This is followed by a reply by Beanes to a former article in that journal concerning the same subject.

Electric Furnaces. RICHARD. *L'Eclairage Elec.*, Dec. 11.—Brief, well illustrated descriptions of a number of furnaces, taken apparently from patent specifications.

Furnaces.—Zeit. f. Elektrochemie, Dec. 20.—Illustrated descriptions taken from German patents, of different forms of electric furnaces.

Gutta Percha. OBACH. Lond. *Elec.*, Dec. 17.—A brief abstract of his third and last Cantor lecture.

Biographical.—Zeit. f. Elektrochemie, Dec. 20.—Brief biographies with portraits of Werner v. Siemens and J. G. Halske.

Miscellaneous.—Lond. *Elec.*, Dec. 24.—A dozen brief supposed abstracts of papers by different well-known authors; they are written in a humorous style, and are intended to call attention to the characteristics of those authors.

Electrical Advance in the Past Ten Years. E. THOMSON. *Forum*, Jan.—An article of a general character intended chiefly for the non-electrical reader, in which he recalls some of the more notable events in applied electricity which occurred in the late '70's up to a period ten years ago, and then describes briefly the large number of applications of electricity which have been developed during the last decade. Among other things he states that no limit of electrical power transmission can yet be definitely fixed, but that at present the range of distances is between 30 and 100 miles; concerning electric traction he remarks that the future will witness the growing substitution of single motor cars or two or three coupled cars, for long heavy trains drawn by locomotives; the present outlook for electric railway expansion is most encouraging; regarding the Marconi system of wireless telegraphy he states that it may be of limited use, but will not replace telegraph lines or submarine cables; in conclusion he shows how electrical work has had a powerful effect on the development of many other arts.

Probable Developments During 1898. SHORT. *Elec. Rev.*, Jan 5.—A very brief article in which, after a short review of the past, he mentions as one of the possibilities for the next year the solution of the problem of the production of electricity direct from carbon; for traction, which is the most important application of to-day, electricity will be extended to heavier burdens, and he thinks it safe to predict that there will be a change from the single reduction to the gearless motor for heavy high speed traction; some better system will be devised whereby the entire train will be under perfect control of the motorman.

Minerals and Metals.—Eng. and Min. Jour., Jan. 1.—The whole of this issue is devoted to the excellent annual mineral statistics for the past year prepared by that journal; it covers thirty-four pages.

Application of Lifting Magnets.—Cassier's Mag., Jan.—A brief account of a suggestion to apply magnets in the raising of iron or steel vessels sunk in deep water where divers cannot be used, as for instance, in the case of the Victoria, which lies in the water 450 feet deep; the total weight is 7000 tons, and it is proposed to use magnets, each of which has a lifting power of 100 tons; when these have all been attached, the vessel is to be raised sufficiently near to the surface to be towed into shallower water; the estimated cost of doing this is about half a million dollars.

Book Reviews.

ELECTRIC TOY MAKING FOR AMATEURS, including Batteries, Magnets, Motors, Miscellaneous Toys and Dynamo Construction. By T. O'Conor Sloane. Third edition; cloth; 12mo, 140 pages, 53 illustrations. Published by Norman W. Henley & Co., New York. Price, $1.

This interesting little book is of the practical kind that will become thumb worn and dog eared and much beloved by any ingenious boy. It describes a number of interesting electrical playthings, and gives practical directions for making them.

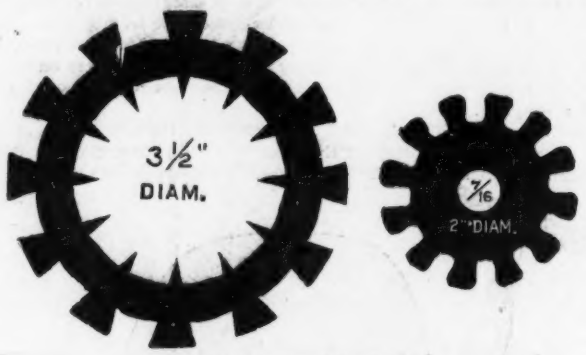
TRANSMISSIONI E DISTRIBUZIONI POLIFASI (Polyphase Transmission and Distribution). By Professor Riccardo Arno. Cloth, 12mo, 34 pages, 26 figures. Published by Unione-Tipografico-Editrice, Turin. Price, $1.

This little book is one of the masterly series of electrical text books recently published by Professor Arnò. Its five chapters treat, after a brief introduction to Polyphase Systems in General, of Current Combinations in Polyphase Systems, Three-phase Systems, Transformation from Three-phase to Two-phase and vice versa, Transformations of Single Phase into Two and Three-phase Systems, and Special Polyphase Systems.

It cannot be long before the value and utility of this excellent series of electrical texts will result in the publication of an English translation, making it more available to a great number of students.

Small Armature Discs.

The proper machinery for stamping out toothed armature discs for small dynamos and motors is not always a possession of those who undertake such work, and they who attempt the construction of such machines find it difficult to make discs of sufficient accuracy to insure the production of a well-constructed armature. The Mianus Electric Company, Mianus, Conn., has come



SMALL ARMATURE DISCS.

to the aid of those who labor under these difficulties, and offers punchings of several sizes ranging in diameter from 1¼ inches to 4 inches. The discs are made of very soft iron, rolled especially for the purpose, and may be purchased in any quantity, large or small. Punchings for ring and drum armatures are shown in the illustration. The Mianus Company makes discs of special sizes to order.

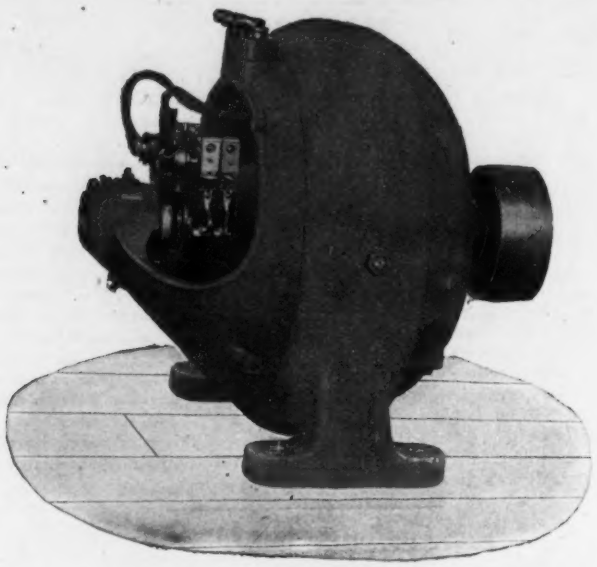
New Slow-Speed Belt-Driven Generators.

The General Electric Company announces in a recent bulletin a line of new and improved slow and moderate speed belt-driven generators. These machines are of the bipolar and four-pole types. The four-pole construction allows of an extremely economical distribution of the magnetic material, while by shortening the magnetic circuits the exciting current is reduced, and the efficiency increased. As the frames are of the highest quality of iron, and the pole pieces of special soft steel, these generators are lighter than even others of the same output, but higher speed. The floor space occupied is small; the frame is strong, rigid and graceful, and the dimensions are as small as possible consistent with stability. The mechanical construction of the bearings, shaft and oiling devices is such as to make the operation of the machines safe and easy even to unskilled attendants. The comparatively low belt speed, even in the smallest machines, results in less wear and tear of belts and bearings, and noiseless running.

The pole pieces are of special soft steel of the highest magnetic permeability. As they are detachable from the frame, the field coils are removable without disturbing the armature. The armature is built up of japanned sheet iron laminations assembled on a cast-iron spider. Air ducts separate the laminations into groups and provide for thorough circulation through the windings, core and spider. The windings are copper-wire coils, formed and insulated before assembling on the core. In some of the larger sizes copper-bar windings are used. By means of a projecting spider the windings are bound down solidly and additional radiating surface provided. The commutator is built up of special hard-drawn copper and mica of the finest quality. The brush-holder boxes, which hold the carbon brushes, are connected to the stud by a solid shank, insuring correct brush setting and firm and accurate contact with the com-

mutator. A flexible conductor permanently attached to the brush forms perfect connection to the brush holder. Adjustments for pressure are made by a thumb nut and pressure spring. The pillow blocks are cast with the bed plate, and the bearings are self-aligning and self-oiling.

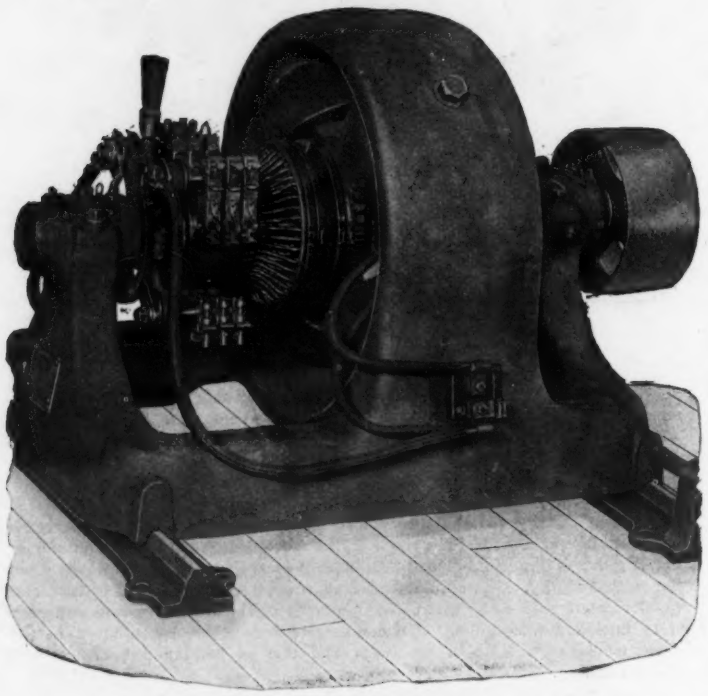
The rise in temperature in any part of the machine, except the commutator, will not exceed 45° C., after a continuous full load-run of ten hours. The temperature rise of the commutator under the same conditions will not exceed 55° C. All parts of the machine are interchangeable, and as the substitution of new parts requires no special skill or knowledge, any change can readily be made by the attendant.



I. B. Generator.

The four-pole machines of the slow-speed type are built in capacities from 6.5 kilowatts to 75 kilowatts; of the moderate-speed type from 9 kilowatts to 85 kilowatts. They are wound for 125, 250 and 500 volts. Many of them can be adapted for direct coupling to engines by mounting the machine on an extension of the engine bed, and connecting the armature to the engine shaft through a coupling.

The smaller sizes of the slow and moderate speed generators are of the bipolar type, and, while embodying the same style of construction as the four-pole machines, differ greatly in appearance. They are known as I. B. (iron-clad bipolar) machines, and, as will be seen, have a field frame completely surrounding and protecting from mechanical injury both field spools and armature. The small size of these generators, their compactness, and the small floor space occupied, render them peculiarly suitable for small isolated plants, and, being adapted for direct driving, they make neat sets for small yacht and launch plants. The slow-speed I. B. generators range in capacity from three-fourths kilowatt to 4½ kilowatts; the moderate speed from 3½ kilowatts to 7½ kilowatts. All are wound for 125, 250 and 500 volts.



Four-Pole Slow Speed Generator.

Ideal Circuit Breaker.

A novel circuit breaker has been put on the market by the Ideal Electric Corporation, of New York, the apparatus differing somewhat from anything yet offered to the public. The movements of the blades, or contact bars, are in a vertical position, having a reciprocating motion up and down.

The illustration (Fig. 1) shows a circuit breaker of the double-pole type,

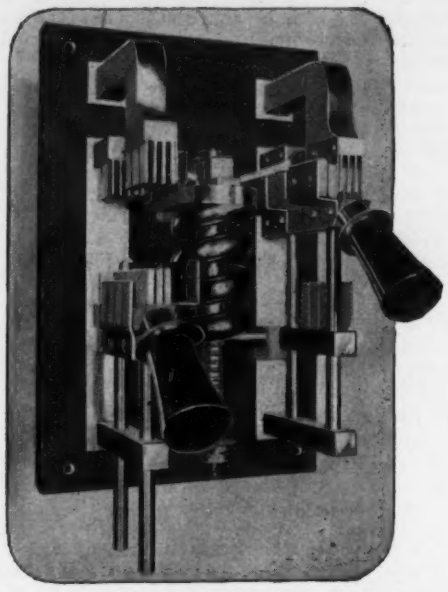


Fig. 1.—Double-Pole Circuit Breaker.

each pole working independently of the other, so that if an overload or short circuit should occur, both blades drop simultaneously. After closing one side of the switch, if the overload or short circuit still exists, in attempting to close the other side, the side already closed will instantly and automatically open. By this arrangement it is practically impossible to close the circuit breaker as long as an abnormal amount of current is passing. The most commanding feature of this switch is that at no time during the entire action of opening or closing, does any part protrude more than 6 inches from the face of the switchboard, thereby avoiding the danger of striking the operator, and very often injuring him. A man of ordinary strength can with rapidity and ease close circuit breakers of this type up to 5000 amperes capacity. All conducting parts are made of hard-drawn copper, and all parts not made of copper are heavily copper plated, the entire switch being highly polished and lacquered.

The switch is self-contained and can be easily mounted on the switchboard, no lining up being necessary.

Fig. 2 shows the template and all the drilling necessary for a 500-ampere breaker. In the operation of other circuit breakers two large compression springs are commonly used, but in the Ideal there is only one small one, gravity doing the rest. These breakers are also provided with an evenly divided scale, and can be adjusted from 40 per cent. to 50 per cent. overload.

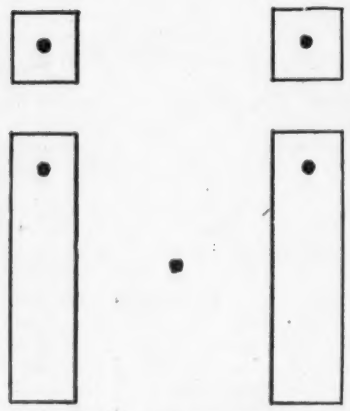


Fig. 2.—Template.

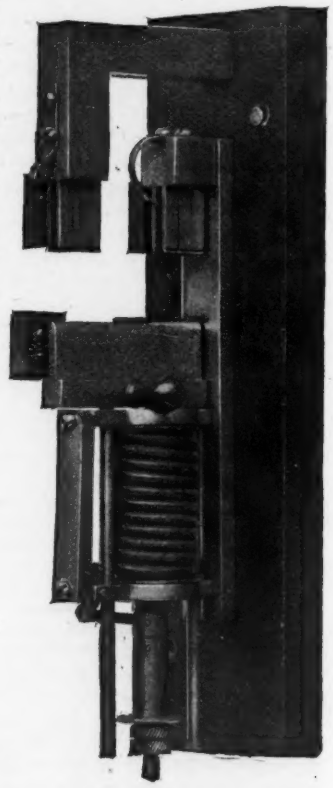


Fig. 3.—Single-Pole Circuit Breaker.

Fig. 3 shows a self-contained single-pole breaker for panel and switchboard work. Only three holes need be drilled in the switchboard to mount the breaker. With the Ideal independent circuit breaker no auxiliary switch is necessary, on account of its independent action.

News of the Week

Financial Intelligence.

THE CHICAGO EDISON COMPANY has increased its outstanding issue of first mortgage 5 per cent. gold bonds by $400,000. This makes the total amount of these bonds now outstanding $2,975,000.

THE ELECTRIC VEHICLE COMPANY, of New York, has offered for subscription at par $250,000 8 per cent. preferred stock, with a bonus of 100 shares of common with each 100 shares of preferred. The entire issue has been underwritten by a syndicate. It is to pay for 100 vehicles now being built, to equip the station in New York, and to provide working capital.

BROOKLYN RAPID TRANSIT STOCK was actively dealt in during the past week. The stimulus in the buying came, it is thought, partly from the general strength in traction stocks and partly from the clearing away of obstacles in the crossing of the bridge. It has been estimated that by crossing the bridge more than $1000 a day would be added to the earnings of the company.

Special Correspondence.

New York Notes.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Jan. 10 1898.

THE WESTERN UNION TELEGRAPH COMPANY on January 8 laid a new cable between Governor's Island and the Battery, to take the place of the cable laid eight months ago that was torn up by the anchor of some vessel. The new cable is heavily armored, being 3 inches in diameter. It is 3000 feet long.

MEETING OF THE NEW YORK ELECTRICAL SOCIETY.—The 184th meeting of the New York Electrical Society will be held at the College of the City of New York, Twenty-third Street and Lexington Avenue, on Wednesday, January 12, at 8 P. M. Mr. S. Dana Greene will read a paper entitled "The Relations Between the Customer, the Consulting Engineer and the Electric Manufacturer." It will be the aim of Mr. Greene in this paper to assist in bringing about that better understanding between these departments of the industry on which much of its prosperity and welfare depends.

ANOTHER SUBWAY for telephone and telegraph wires has been laid under the Harlem River, connecting Manhattan Island with the mainland. The subway is of wooden construction, with eight conduits, in which the cables may be drawn. The wooden shell is about 2 feet in diameter, built up of Georgia pine, wound with wrought iron hoops at intervals of 3 feet. It was constructed in three sections, two with a length of 220 feet each, the other 117 feet in length. These sections were floated into place, bound together and then sunk into a trench which had been dredged out some 8 feet deep across the bottom of the river. The tubes through which cables may be drawn are lined with 4-inch iron piping, covered with asphaltum. The cables have heretofore been simply laid on the bottom of the river, and they were frequently damaged by dredges, anchors and other sources of disturbance. The new conduit is so solid, and will be so deeply buried when the sand and mud have drifted over it, that it will be practically free from these disturbances.

AWARD OF STREET LIGHTING CONTRACTS.—On December 30 last contracts for electric lighting in Manhattan and Bronx Boroughs during 1898 were awarded as follows: The Brush Electric Illuminating Company, 91 arc lights, at 45 cents each a night; 975 arc lights, at 40 cents each. The Mount Morris Electric Light Company, 630 arc lights, at 40 cents, and 194 arc lights, at 45 cents. This company will light the Harlem Speedway. The Manhattan Electric Light Company, 10 arc lights, at 50 cents, and 840 arc lights, at 40 cents. This company will light Park Avenue under the elevated structure of the New York Central in Harlem with 100 incandescent electric lights, at $22.50 a year for each light. The Harlem Lighting Company, 66 arc lights, at 40 cents, and 19 arc lights at 50 cents. Edison Electric Illuminating Company, 524 arc lights, at 40 cents, and 363 arc lights, at 50 cents. North River Electric Light & Power Company, 1,052 arc lights, at 45 cents. The Pelham Electric Company, 95 arc lights, at 40 cents. Under the provisions of the new city charter city lighting comes under the control of the Department of Public Buildings, Lighting and Supplies.

MAYOR VAN WYCK'S POSITION ON THE TUNNEL QUESTION.—The utterances of Mayor Van Wyck in his message to the Municipal Assembly of New York City in relation to the subject of the proposed rapid transit tunnel were somewhat disheartening to the supporters and advocates of that enterprise. The demand for a safe, speedy and comfortable mode of travel is well justified, he says. Personally, he favors any and every lawful endeavor which will furnish relief to the people whose homes are situated at such distances from their places of business or employment that they find the present means of transit inadequate and burdensome. It is to be regretted, he says, that the court proceedings recently had regarding the plans submitted, and the very important and far-reaching questions then and there raised, make it apparent that some other form of relief must be decided upon, or our justly impatient people will be required to wait during a very indefinite period covering certainly a number of years before a final decision can be had in the tedious litigations already begun and threatened. He calls the attention of the assembly to its solemn duty to refuse any public expenditure, no matter for what purpose intended, which is likely to cast even a shadow upon the credit of the municipality, or which invites the evasion or violation of the constitutional limitation in the issue of bonds. The citizens, he continues, will certainly no longer tolerate, much less excuse, delay upon delay, at the cost of not alone the comfort and convenience of the people, but also the increased valuations which in a considerable degree would add to the public revenues if the rapidly growing districts most directly interested were furnished with greater and improved facilities of traffic. He advocates the best possible use of the present facilities as, by improvement and extension, can be made available by a fixed and definite time for some relief in the direction of the popular demand. The mayor speaks to the point on the question of utilizing electric power on the elevated railways in place of steam. In this connection he says that there is not sufficient reason for the continued employment of the locomotives, and that the people should no longer be subjected to the resulting nuisances of smoke, noise and flying cinders. "You should demand and insist upon substitution," he says to the assembly, "in the place of the present motive power, of electricity, which can now be safely utilized in the operation of these roads, affording more cleanly and less noisy service, and that, too, with an improvement in speed." The trunk elevated lines, in his opinion, should be so extended as to furnish more convenient communication with the ferries, and the railroad corporations should be compelled to continue the present routes to the more sparsely settled and more distant localities, even if for a time some loss is entailed upon them by so doing. The surface railroads, likewise, should be required to adopt the best approved motor power. Wherever the present service can be improved with fairness to the corporations concerned, the public should be convenienced with more cars and a reduced time interval in the running of them. When the comfort and convenience of the public is disregarded he urges the assembly to exert its authority to the utmost to secure its recognition by all engaged in the operation of public franchises. The result desired, the mayor says, in conclusion, is that all the positive relief possible be at once furnished with the facilities of travel now under the control of the assembly.

New England Note.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., Jan. 8, 1898.

ELECTION OF OFFICERS OF THE BOSTON ELEVATED RAILROAD COMPANY.—The directors of the Boston Elevated Railroad Company at their meeting on January 7, elected officers as follows: William A. Gaston, president; William A. Bancroft, vice-president; William Hooper, treasurer; John T. Burnett, secretary and clerk. The new executive committee consists of the following named gentlemen: William A. Gaston, William A. Bancroft, T. Jefferson Coolidge, Jr., James M. Prendergast and Robert Winsor.

Southern Notes.

WASHINGTON, D C., Jan. 8, 1898.

THE FOURTEENTH STREET BRANCH of the Capital Traction Company's electric system is ready for operation. It is thought that the entire system will be in running order by February.

THE HUNTSVILLE ELECTRIC LIGHT & POWER COMPANY, Huntsville, Ala., has let the contract for the erection of a new power house. Over $10,000 will be expended in improving the plant.

THE REFUSAL of the Richmond, Va., City Council to grant the Bell Telephone Company permission to enter the city has not kept the long-distance company out of Richmond. The Southern Bell Company, which continues to do business there against the council's will, and by order of the Federal Court, has established connection with the Manchester exchange, and opened an office from which conversation may be held over the long-distance company's circuits.

Buffalo and Niagara Falls Notes.

BUFFALO, N. Y., Jan. 6, 1898.

THE CATARACT POWER & CONDUIT COMPANY'S advertisement, announcing that it was prepared to furnish Niagara electric power in Buffalo in unlimited quantities, has been met by a surprising and most gratifying amount of inquiry on the part of owners of steam plants about the city. In all, about 100 inquiries have been received, that will eventually develop into applications and probable contracts.

ASSISTANT SECRETARY DE LANCEY RANKINE, of the Niagara Falls Power Company, this week established his office with the Buffalo General Electric Company, at 40 Court Street, Buffalo; and will open books for the leasing of power. No effort will be made to open the streets until spring, however, as the cost of excavation at this season of the year is about three times that during the warmer season. The first line will be run up Genessee Street to the Urban flour mill.

THE BUFFALO GENERAL ELECTRIC COMPANY in the spring will be in the market for Niagara power. The long-abandoned light station at Black Rock, left unused by the consolidation of the United States Company with the Buffalo General Electric Company, will be utilized as a transformer house to supply that district. As soon as the Buffalo General Electric Company

obtains the Niagara current it will increase its list of small customers in the line of power as well as light, in order to provide a larger day load. The company is now using a direct-current 500-volt generator for this service, and will look for a monopoly of it, in spite of the Niagara current, which will not be sold in less amounts than 75 horse-power.

Chicago Note.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., Jan. 7, 1898.

THREE NEW TELEPHONE EXCHANGES FOR CHICAGO.—The Chicago Telephone Company has completed arrangements to establish three new exchanges, two downtown and one in the business district of the West Side. One of the new exchanges is to be in the Title & Trust Building; another will be in the Manhattan Building. The telephone business in this city is reported by General Manager A. S. Hibbard to be very rapidly increasing. Not only have more instruments been put in, but the old ones are being used in many cases three or four times as much as before. One year ago the number of daily calls in Chicago was about 180,000; now it is about 240,000.

Milwaukee Notes.

MILWAUKEE, Wis., Jan. 6, 1898.

MR. A. E. RUSK has been discharged by the court as receiver for the National Electric Manufacturing Company, Eau Claire, Wis.

A MORTGAGE of $250,000 on the Citizens Traction Company, Oshkosh, Wis., has been filed. It is to secure bonds held by the West End Trust & Safe Deposit Company, of Philadelphia.

MESSRS. E. A. FORBES and C. A. Wilson, of Gladstone, Mich., have purchased the Faust electric light plant of Rhinelander, Wis. The plant was put in operation in 1889, and furnishes current to 2000 incandescent and forty-seven arc lamps.

THE ELECTRIC LIGHT PLANT of the St. Zoerlaut Leather Company is being enlarged. A 40-kw Card generator will be direct-connected to an Alfree engine. A new switchboard, 325 incandescent and 20 arc lamps will be installed. The tannery may be electrically equipped with power. If this plan is carried out more generators and several motors will be required.

THE MARINETTE & MENOMINEE ELECTRICAL COMPANY has been organized at Marinette, Wis., with a capital of $200,000. The power of Chapple Rapids, on the Menominee River, is to be developed, and it is estimated that 3000 horse-power can be obtained. The dam is to be built this winter, and the rest of the improvements will be made in the spring. The cost is estimated at $150,000. It may be that this work is but the beginning of greater improvements, as there are two other rapids on the Menominee River, and one on the Peshtigo River, all near enough to be utilized in Marinette and Menominee. The total power of all these rapids is estimated to be about 10,000 horse-power. It is said that several manufacturing concerns are waiting for the power to be developed, with a view of locating in the vicinity.

Pittsburg Notes.

PITTSBURG, Pa., Jan. 7, 1898.

DIVIDEND DECLARED.—The directors of the Standard Underground Cable Company have declared a quarterly dividend of 1¼ per cent. on the capital stock of the company, for which checks will be mailed to the stockholders on January 10. The transfer books will be closed from January 5 to 10 inclusive.

CAPITAL STOCK INCREASED.—The directors of the Allegheny County Light Company last week decided to issue $250,000 additional stock, making a total of $1,500,000 now issued. The new issue is distributed among the stockholders as a 20 per cent. stock dividend upon their present holdings. A stockholders' meeting is to be held in March to consider the advisability of authorizing a further increase in the capital stock of the company, to provide for the extensive improvements that have been made and that are planned for future execution, in the station equipment and distributing system of the company. This company has for many years paid cash dividends at the rate of 6 per cent. per annum. Its general offices have just been removed from the Westinghouse Building, at Ninth Street and Penn Avenue, to new and commodious quarters at Thirteenth and Pike Streets, adjoining its new station.

TRACTION COMPANIES MUST PAY BRIDGE TOLL.—In the suit brought by the Pittsburg & Birmingham Traction Company against the city of Pittsburg, the Supreme Court has just confirmed the decision of the lower court against the traction company. Nominally, the suit was brought against the Monongahela Bridge Company, whose stock was all acquired by the city some time ago. Some years prior to the purchase of the bridge by the city, a contract was made between the bridge company and the traction company, in which the latter agreed to widen the bridge, at its own expense, so that its cars might use the structure. It was to repay itself the cost of the improvement by keeping back each year, for a certain period, a portion of the tolls due the bridge company for use of the bridge. When the city purchased the bridge and declared it free to the public, the traction company not only refused to pay any more tolls, but brought suit to recover the unpaid balance of the money advanced for the widening of the bridge. The two decisions adverse to the traction company seem to establish the right of the city to collect from street railway companies for their use of the free bridges.

DAMAGE DONE BY HEAVY SNOW STORM.—On Friday, December 31, occurred a fall of snow that turned out to be the most disastrous to the electrical interests that ever occurred in Pittsburg. Beginning before daylight, and continuing until evening, the total fall was only 12 inches or so, but the snow was the wet, clinging, heavy kind that is so disastrous to pole lines and street railway service. Telephone and other wires were soon loaded so that they looked as large as ship cables. Hundreds of wires were broken and many poles succumbed to the stress imposed by the weight of the snow. On Forbes Street a stretch of the C., D. & P. Company's telephone line, eight poles, came down, blocking traffic for several hours. Several horses were killed as a result of the broken telephone wires getting mixed up with the trolley wires. The Western Union and Postal Telegraph Companies suffered heavily, and for some hours eastbound telegraph business was sent out by way of Chicago. The trolley roads abandoned all schedules early in the morning, and not until evening was any regularity in running resumed. The sweepers were actively at work all day, but they had hard work with the heavy snow. The city's fire alarm and police signal service was utterly prostrated, and a large force of extra patrolmen was kept on duty all Friday night and Saturday to give prompt notice of fires, etc. By Monday morning temporary repairs had been made, so that all classes of service were working much as usual, but it will require several weeks of hard work and thousands of dollars to remedy permanently the devastation wrought by the storm. Several companies had reason to congratulate themselves that so many of their conductors were safely hidden away underground. Fortunately no human fatalities were reported as a result of the many entanglements of overhead wires that occurred.

St. Louis Notes.

ST. LOUIS, Mo., Jan. 7, 1898.

TALK ON STREET RAILWAYS.—At the meeting of the Engineers' Club, held last night, Richard McCulloch delivered an address entitled "A Historical Sketch of Street Railways."

THE MANHATTAN ELECTRIC COMPANY filed articles of incorporation December 30 with a capital stock of $4,500, fully paid. Elliot Jones, Albert E. Boeschenstein, George J. Percival are the incorporators.

THERE IS SOME TALK of a belt electric railway on the East Side, to connect all the towns within a radius of 20 miles of East St. Louis. This is what the St. Louis & Belleville Suburban Railroad Company contemplated doing, and was one of the various reasons that led the company to build the railroad from Belleville to East St. Louis.

THE MIDLAND BRANCH of the Lindell Railway is to be extended to Creve Cœur Lake. The Overland Real Estate Company will build it. It agrees to give the Midland Company $10,000 in cash; 100 shares of the stock, valued at $10,000; a 50-foot right of way, and a rectangular tract embracing five acres at the end of the line for a loop, and agrees to complete the road in 1899.

MR. C. A. COOPER, formerly with the Columbia Incandescent Lamp Company, has established an office in the Commercial Building, and represents the K. & W. Company, of Pittsfield, Mass., manufacturers of the Hardy incandescent lamp and other electrical supplies. He is a progressive young man and a hustler, and the company has made a wise selection in having him as its representative.

Texas Notes.

SAN ANTONIO, Texas, Jan. 3, 1898.

BATESVILLE, ARK., has decided to invest $22,000 in an electric light plant and water works. The contract for these improvements will soon be let.

THE HUNTSVILLE ELECTRIC LIGHT & ICE COMPANY, of Huntsville, Tex., has filed papers with the Secretary of State amending its charter. The amendment authorizes the company to increase its capital stock from $6500 to $9000. New machinery will be purchased.

ADVICES have just been received here from Washington to the effect that the decision of the lower court in the case of the Pennsylvania Mutual Life Insurance Company vs. the city of Austin, Tex., has been affirmed by the Supreme Court of the United States. Plaintiffs are large bondholders of the Austin Water, Light & Power Company, and sought to enjoin the city from operating its dam, water and electric light plant before the expiration of a contract made with said company to use its water and lights for a certain number of years. The injunction was refused in the United States Circuit Court, and when the case came up for trial the bill was dismissed, the court holding that plaintiffs' relief was in an action for damages, which holding has been sustained by the Supreme Court.

Mexican Notes.

MONTEREY, Mexico, Jan. 1, 1898.

A PROJECT IS ON FOOT to introduce electric power on the street railway system of the city of San Luis Potosi. Negotiations are pending for the purchase of the system by an American company, and, if the deal is made, electric power will be applied. San Luis Potosi is a city of about 80,000 people, and its mule car street railway lines are now well conducted.

THE FALLS OF JUANACATLAN, situated in the State of Jalisco, are capable of furnishing power for a great number of manufacturing concerns, and a syndicate of American capitalists is now considering the matter of establishing an immense power plant at these falls, similar to that now located at Niagara Falls, only on a smaller scale. The falls of Juanacatlan are called the "Niagara of Mexico." They are on the River Lerma, which drains Lake Chapala. The falls make a leap of 600 feet, and have a width of 200 feet. In addition to furnishing the power for the electric light plant of the city of Guadalajara, these falls are soon to be used as a source of power for a large cotton mill, which is now being removed there from the City of Mexico. There are a number of other large water falls in Mexico, which in the near future will furnish power for industries of various kinds. In the State of Puebla a whole river makes a downward leap of 997 feet. There are several falls on a river in the State of San Luis Potosi of from 300 to 500 feet.

PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., Jan. 2, 1898.

NAMED AFTER TESLA.—The Corral Hollow Coal Company is building a town, near its mine in Alameda County, Cal., which will be named Tesla. Five hundred men will soon be employed in taking out coal from the mine, which is now being operated according to new plans. An electric haulage system will be installed to transfer the coal cars from the shaft to the bunkers.

THE FINANCE & CONSTRUCTION COMPANY, San Francisco, has closed a contract with the San Joaquin Power Company, of Fresno, Cal., to build the Hanford extension of its three-phase system. The voltage of the transmission line will be 19,000, and glass insulators will be used. The total distance covered between Fresno and Hanford will be 67 miles. C. S. Dutcher has gone to Fresno to attend to some of the engineering.

THE DYEA-KLONDIKE TRANSPORTATION COMPANY'S aerial tramway over the Chilkoot Pass, Alaska, referred to in the last issue of THE ELECTRICAL WORLD, will be operated at first by a temporary steam plant, in Dyea, driving a Westinghouse two-phase 45-kw generator. The current will be transmitted 20 miles by the Scott system, and will actuate electric drums near the summit of the pass. There will be about 6900 feet of Telfer-system aerial tramway, constructed, probably, in two sections. Mr. W. A. Burkholder expects to spend three months in installing the system.

THE ELECTRICAL ARRANGEMENTS for unfurling the flag of Greater New York, by the pressing of a key by Mayor Phelan in San Francisco, were skillfully carried out at this end of the circuit. Supt. L. W. Storror, of the Pacific Postal-Telegraph Cable Company, aided by his electrical staff, made up the circuit at 8:30 P. M., San Francisco time, and the circuit was opened at 11:59, New York time. The zigzag circuit was 3700 miles in length. It extended from the Postal Company's operating rooms in the *Examiner* office to Lathrop, Cal., to Mohave, Cal., to Albuquerque, N. Mex., to La Junta, to Kansas City, to Des Moines, Ia., to Chicago, to Meadville, Pa., to New York.

THE ROZENHOLZ ELECTRIC ROCK DRILL, which is manufactured by the Union Machine Company, in San Francisco, is now perfected, and the inventor has shipped one of them to Nevada City, Cal., where it will be operated practically in refractory rock. The 2½-hp, 220-volt Westinghouse motor is mounted separately from the drilling mechanism, which resembles, externally, the Burleigh drill. The transmitting shaft can be adjusted to any desired angle. The novel feature of the machine is the air-cushioned cylindrical cross-head, which enables the mechanism to endure shocks that would soon destroy apparatus of other types. The reciprocating parts make 400 strokes a minute. A 5-hp motor is said to be sufficiently powerful to operate the largest size.

MUNICIPAL PLANT PROPOSED FOR OAKLAND.—The subject of establishing a municipal electric lighting plant in Oakland, Cal., has been agitated of late. City Councilman F. R. Girard recently presented to the council a report upon the municipal ownership of an electric light plant. The following items were included: Oakland has about 520 arc lights, which cost about 45 cents per night, or $140 per light per year, while Alameda, with only 102 arc lights (municipal plant), pays only about $85 a year per arc light. The city of Oakland spent last year about $70,000 for street lighting, and the estimate for this year is about $80,000. The estimated cost of a complete electric light plant to supply Oakland with 600 arc lights (also some incandescents) is $107,000, including building site, boilers and engines. The Realty Syndicate, having purchased and consolidated nearly all of the street railroads, is about to operate its railroad lines from one central power station. An opportunity is now presented whereby the city can buy one of the syndicate's old power houses and save the cost of erecting buildings in which to install a municipal plant.

CANADIAN NOTES.

OTTAWA, ONT., Jan. 8, 1898.

THE MONTREAL ELECTRIC STREET RAILWAY COMPANY has just completed the printing of 15,000,000 street car tickets. The issue cost of these tickets was in all about $1100, and for the privilege of advertising on the back of each ticket the company received $3000, making a clear profit of $1900 upon the scheme.

THE CHAMBLY PLANT.—Prominent men of Montreal recently made an excursion to Chambly, Que., for the purpose of passing an opinion upon the works of the Chambly Light & Power Company. Among the number was Mr. F. S. Pierson, chief engineer of the Metropolitan Traction Company, of New York. Mr. Pierson gave it as his opinion that the Chambly plant was as perfect as any he had ever seen.

TO ENCOURAGE THE DEVELOPMENT OF NIAGARA POWER.—A motion has been introduced into the Ontario Legislature to the effect that, in the opinion of the house, the water-power of Niagara Falls and rapids, being one of the great natural resources of the province, should be developed and utilized for the benefit of the Canadian people, and that to this end the Government should favor all bona fide enterprises proposing the development of this power.

SUNDAY STREET CARS IN MANITOBA.—It is reported that an effort will be made at the coming session of the Manitoba Legislature to remove from the municipal act the clause which prevents the citizens of Winnipeg from voting on a Sunday electric street car service by-law without the consent of the legislature. This clause, it is alleged, found its way into the act only by a fluke, as it had been intended to vote down the motion favoring it in committee, but through the misunderstanding of a member the arrangement miscarried.

THE DOMINION GOVERNMENT proposes putting in an electrical installation in all departmental buildings in Ottawa. At present the Houses of Parliament furnish their own electricity for lighting purposes. The intention is to erect a power house to supply all the Government buildings with electric lights, and also with electrical energy to work electric pumps for fire purposes in every building. The annual cost now for gas is $23,000, and the electric system is estimated to effect a saving of $13,000 a year. There will be about 4000 incandescent lights in the several buildings. The total cost is estimated at less than $80,000.

THE NIAGARA POWER COMPANY, if forced to develop power on the Canadian side of the line, must look to Toronto, it is said, for an immediate market, to which city the question of power transmission is already being considered by the company. The rival concern, which proposes to utilize the Welland River power, also looks to the city of Toronto for its most important market. The Electric Light Company, of Toronto, which has a large amount invested in plant for the production of electricity from steam, will not eagerly welcome the advent of water-produced power, and is making a strong fight against its introduction. The people of Toronto, however, want Niagara power, and want the City Council to run the electric business, and will not rest content until they have gained both.

FRENCH NOTES.

(From Our Own Correspondent.)

PARIS, France, Dec. 24, 1897.

THE ELECTRIC STATION OF THE JONAGE CANAL.—All the machinery of the electric station of the Jonage Canal, near Lyons, is ready and awaits the starting of the turbines and dynamos, which are to furnish power and light to the neighboring region. Already 100 kilometres (60 miles) of conducting lines are in place. While awaiting the completion and starting of the hydraulic station (which cannot be much longer delayed), the company has installed a temporary station at Lyons.

THE HEILMANN LOCOMOTIVE.—Reverting to the first trials of M. Heilmann's electric locomotive on the Western lines, it may be said that, putting aside both excessive eulogy and unreasonable criticism, no definite judgment can yet be pronounced. More precise data than those given by these first trials are needed. Whatever else the result of these experiments, they have had the good effect of attracting the attention of other railway companies to this application of electric energy. The Compagnie Paris-Lyons-Mediterranée wishes also to have its own electric locomotive, or something that looks like one, and by next spring it is to be hoped that an account of progress accomplished toward a definite understanding of this machine may be given.

ELECTRIC AUTOMOBILES.—The Société des Voitures Electriques, using the Krieger system, the large and well-known Parisian carriage works, which was established in 1895, will probably soon be known by the title of Compagnie des Automobiles Electriques, it being now on the point of changing its organization, and making its capital 5,000,000 francs ($1,000,000). According to some comparative calculations of all the costs of installation and operation required by animal, oil-motor, and electric traction, this company states that all the advantages of economy lie with the electric system. For daily costs of operating cabs they give:

For animal traction	15.44 francs	($3.10)
For a petroleum automobile	13.20 "	($2.65)
For an electric automobile	8.13 "	($1.63)

DESTRUCTION OF BLACK ROT BY CALCIUM CARBIDE.—One of the gravest among the numerous maladies from which the vine suffers is black rot. Happily, remedies of more or less efficacy have been found for most of them, remedies which will at least ameliorate the disease and frequently save the vineyard from otherwise certain destruction. M. G. Rodier has just made public a fact which has been carefully guarded, and which experiments conducted last September among the vineyards producing some of the best known white wines (Sauternes) have made certain. The young and still green bunches of grapes attracted by the black rot were dusted over with powdered calcium carbide. A few days later the coating of lime left after the disengagement of acetylene was brushed off, and all the spores of the black rot had disappeared. The experiments will be continued during the next season. This seems to open up a new application for calcium carbide, of which it will be hard to predict the outcome.

NEW WATER POWER INSTALLATIONS IN THE PROVINCES.—At Chambery, in Savoy, the Société Electrochimique de Giffre has just been incorporated with a capital of $200,000 to utilize the falls of the Giffre, near Mieussy, Haute Savoie, which will develop about 8500 horse-power. The city of Limoges has undertaken the project of damming the gorge of the Taurion and conducting a part of the water by a canal of some kilometres length to a cliff about 125 feet high. Here the water will be led by two penstocks into the turbines of the station below. The energy is to be transmitted electrically to Limoges. While this work is going on a provisional station has been installed at Pont St. Etienne, which will soon light the whole of Limoges. Tubular boilers of 300 horse-power each are used, and the piping between these and the engines is of copper. Two compound engines are used, coupled direct to one triphase dynamo. After the construction of the water power station this plant will be used as an auxiliary during low water.

A GAS-ELECTRIC LAMP.—For a long time gas and electricity have been bitter enemies. Gas was entrenched in its monopoly, and, forgetful of its own early difficulties, saw with disgust the fact that its new rival, electricity, never failed to discover and exploit all the dangers and defects of gas. Peace is now restored, however, and time will serve only to strengthen it, because to-day much gas is made by electricity. Many means have been suggested to augment the illuminating power of gas. The method of enrichment, by albo-carbon (calcium carbide), or by any other substance, in spite of its present vogue, is hardly the ideal. Electricity offers several means of increasing the intensity of the light from gas jets. If, for example, an ordinary gas burner is fitted with a platinum grating situated in the middle of the flame, and traversed by a current of electricity, the radiation of this grating will augment the illuminating power of the flame considerably, and the light will be both whiter and cooler than that furnished by the simple burner. This platinum screen or grating could evidently be much stronger than any mantle of zirconium or other refractory metallic oxide. Another great advantage of the plati-

num is that only a small current is required to produce the desired effect. several cells of battery, or one or two small cells of accumulator, sufficing to give with an ordinary gas burner five times the light under a consumption of only about half the usual amount of gas. Within certain limits, if the current intensity is increased, the illuminating power increases, and if the current strength is diminished the heat effects increase. It seems astonishing, in discussing this somewhat uncommon application of electricity, seeing the simplicity of this kind of lamp, its easy construction, its ease of practical employment, that it is not yet in public use. It is, perhaps, the most intimate union of gas and electricity.

General News.

New Incorporations.

THE CITIZENS' LIGHT & POWER COMPANY, Larned, Kan., has been organized by E. E. Frizell, Herbert Porter, S. Sleeper, of Larned.

THE LANSING, DEXTER & ANN ARBOR ELECTRIC RAILWAY COMPANY has been organized to build an electric line in Lansing, Mich.

THE MASON COUNTY TELEPHONE COMPANY, Havana, Ill., has been formed by A. F. Terrell and D. W. Wright, with a capital stock of $8,000.

THE NICHOLASVILLE TELEPHONE COMPANY, Nicholasville, Ky., has been incorporated, with a capital stock of $10,000. The incorporators are: R. B. Lancaster, R. X. McElroy, and others.

THE JANESVILLE ELECTRIC LIGHT & POWER COMPANY, Janesville, Wis., has been organized with a capital stock of $25,000. Those interested are E. C. Cock, C. B. Mackensie and others.

THE SALEM ELECTRIC LIGHT & POWER COMPANY, Salem, N. Y., has been formed with a capital stock of $10,000. The directors of the new company are Edgar W. Philo, J. H. Houghton, J. H. Maguire, of Salem, N. Y., and others.

THE ALLENTOWN & EMAUS STREET RAILWAY COMPANY, Allentown, Pa., has been incorporated with a capital stock of $50,000. The incorporators are: F. T. Crilley, John D. Schultz, Patrick F. Cannon, Walter J. Saeger, and others.

THE COMMERCIAL LIGHT, HEAT & POWER COMPANY, New York City, N. Y., has been incorporated with a capital stock of $25,000. The directors are John E. McDonald and Robert L. Woolley, New York City, and William H. Cushing, of Brooklyn.

AVON, N. Y.—At the annual meeting of the Avon Electric Light & Power Company the following named gentlemen were elected officers: Dr. Cyrus B. Allen, president; Alva Carpenter, vice-president; Dr. Irving Allen, secretary and treasurer; and Charles F. Whiting, superintendent.

THE GOSHEN, ELKHART & SOUTHERN RAILROAD COMPANY, Goshen, Ind., has been granted a franchise to construct an electric railway between this place and Elkhart. Among those interested are W. H. Holcomb, Herbert Holcomb, H. K. Hudson, and others.

THE SARANAC LAKE LIGHT, HEAT & POWER COMPANY, Saranac Lake, N. Y., has been incorporated with a capital stock of $100,000. The directors are: Frederick A. Isham and Charles S. Stackpole, New York City; Orlando Blood and Berley A. Gould, Saranac Lake.

THE KANSAS CITY, LAWRENCE & TOPEKA ELECTRICAL RAILWAY & POWER COMPANY, Topeka, Kan., has been incorporated with a capital stock of $3,000,000. It is the intention of the new company to construct an electric railway between Kansas City and Topeka, Kan.

THE ROCHESTER ELECTRIC MANUFACTURING COMPANY has been incorporated at Rochester, N. Y., with a capital stock of $50,000. The officers of the new company are: Hon. William E. Werner, president; J. Miller Kelly, vice-president; George A. Brayer, secretary and treasurer; Louis W. Miller, general superintendent.

The Telegraph and Telephone.

ASHLAND, WIS.—The Wisconsin Valley Telephone Company will build a line from this city to Hurley.

SIOUX CITY, IA.—The long-distance telephone line between Sioux City and Yankton has been completed.

RACINE, WIS.—The Wisconsin Telephone Company will reduce its rates on January 1 for metallic circuit instruments from $60 to $50 a year.

PRINCETON, ILL.—The Central Union Telephone Company is building a new line to Galesburg to accommodate its through business, which is growing rapidly.

COLUMBUS, WIS.—L. L. Phinney, of Poinette, is building a telephone line between Madison and Portage, through the towns on the Madison & Portage Railway.

ST. JOSEPH, MO.—The Missouri & Kansas Telephone Company, it is reported, will spend $225,000 in extending its toll service during the next few months.

COLUMBUS, OHIO.—It is reported that the Pennsylvania Railroad Company has ordered the introduction of long-distance telephone in all offices along its lines.

LANSING, MICH.—An ordinance imposing a tax of $1 on each telephone, telegraph and electric light pole in this city has been adopted by the Common Council.

WALLISVILLE, TEX.—The Gulf & Interstate Railroad proposes to erect and maintain a long-distance telephone system between the towns of Winnie and Wallisville.

CLEVELAND, OHIO.—The Home Telephone Company has been reorganized, with Mr. Howell Hinds as president. Mr. A. L. Davis is treasurer, and F. M. Stearns secretary and manager.

CAIRO, ILL.—Fire on the morning of January 1 destroyed several business houses. Among the places damaged were the Western Union Telegraph office and the Central Union Telephone Company's exchange.

COLUMBUS GROVE, OHIO.—The Ohio Telephone Company, composed of local capitalists, has established an exchange in this place, thus giving the town the advantages of the use of the entire county service.

BEAUMONT, TEX.—The City Council has granted a franchise to the Southwestern Telegraph & Telephone Company. The company will begin the construction of a system within thirty days, and the work will be carried forward as rapidly as possibel.

GILROY, CAL.—A barbed-wire fence telephone system is in operation between the leading ranches of the San Juan Valley. Each farmer provides his own telephone and connection with the barbed wire. It is stated that this crude system works quite satisfactorily.

ST. PAUL, MINN.—The Northwestern Telephone Company, it is stated, has decided not to pay the tax on business passing to and from this State through other States, on the ground that such is interstate business, and has notified the State Treasurer to that effect.

AUBURN, IND.—A franchise has been granted by the Commissioners of Noble County to Henry Inks, of Ligonier, and B. F. Leiser, of Albion, to construct a telephone line connecting Kendalville, Brimfield, Rome City, Avilla, Ligonier, Wawaka, Kimmel, Cromwell and Albion.

CLAY CENTRE, NEB.—At the annual meeting of the Clay County Telephone Company the following named gentlemen were elected officers for the ensuing year: President, L. G. Hurd, Harvard; vice-president, C. J. Furer, Fairfield; secretary-treasurer, J. F. Eller, Harvard.

NILES, MICH.—The Independent Long Distance Telephone Company has commenced work on the extension of its line from Kalamazoo to Chicago. The line will be connected with the local exchanges at Dowagiac, Cassopolis and Niles, in Michigan, and Goshen, Elkhart, South Bend, Laporte and Michigan City, in Indiana.

DETROIT, MICH.—There is some talk of petitioning Congress for an appropriation to lay a telegraph and telephone cable to the Manitou Islands from the mainland. These islands, which are located at the northern end of Lake Michigan, afford a refuge for vessels in stormy weather, and there is now no means of communication with the mainland except by boat.

DES MOINES, IA.—The Conway Telephone Company, with headquarters at Blockton, expects to soon make connection with Des Moines. Six or seven towns may then be reached by the company's lines. At Des Moines the line will connect with the Mutual Exchange, which operates 1160 'phones, thus placing various places in Southern Iowa in direct connection with Des Moines.

BURLINGTON, IA.—The McLean County Telephone Company has closed contracts for a line from this city to Gibson, and it is expected that construction work will commence about the middle of January. Stations will be established at Brokaw, Holder, Padua, Ellsworth and Gibson. At Gibson a connection will be made with an independent exchange, which covers considerable territory in that section.

ISHPEMING, MICH.—The Marquette County Telephone Company, which has its headquarters in this city, has declared a dividend of 10 per cent. The total investment now represents something like $35,000, and it is stated that the stock, which has a par value of $100, is worth $135 per share. The company is operating nearly 800 instruments in the county, and has practically captured the business of the Bell Company in all of the towns reached, with the exception of Marquette. In the latter place it has between 200 and 300 subscribers.

HAVERHILL, MASS.—The People's Telephone Company, of this place, advertises in the Haverhill papers that it is a pay station of the New England Telephone Company, and that it will transmit messages at the regular price of the latter company to any point in the country. The People's Telephone Company has 165 subscribers actually connected, and claims to have applications for 400 more, which are being connected as quickly as the lines can be extended. The New England Telephone Company states that its instrument was put in the People's Company's office as an experiment, and if it turns out to be a paying arrangement it will probably be continued. The People's Company uses Swedish instruments, and charges $25 for business party-line telephones, and $18 for residence instruments.

Electric Light and Power.

COFFEYVILLE, KAN.—This place has voted to issue bonds for electric lighting.

KINGWOOD, W. VA.—The citizens have voted to issue $10,000 in bonds for electric lights.

BRADFORD, PA.—It is proposed to issue $25,000 for the erection of an electric light plant here.

RENSSELAER, N. Y.—The Kinderhook Light and Power Company will erect a power house at this place.

BIRMINGHAM, ALA.—A committee has been appointed to ascertain the cost of establishing a city lighting plant.

DUNCANNON, PA.—The Borough Council has under consideration the establishment of a municipal lighting plant.

ASPINWALL, PA.—The borough wants to issue $25,000 worth of bonds for the purchase of a municipal light and water plant.

LITTLE FALLS, N. Y.—The Dolgeville Electric Light and Power Company has been granted a franchise to operate in this city.

ROMEO, MICH.—The municipal electric light plant has been started, and is working very satisfactorily. The plant cost $13,000.

CAMDEN, N. J.—The South Jersey Heat, Light & Power Company has petitioned the City Council for a franchise. The company will also erect an electric light plant.

FERNANDINA, FLA.—At a meeting of the City Council, the special committee on electric light was authorized to advertise for bids for the erection of an electric light station.

MYSTIC, CONN.—The Mystic Electric & Gas Light Company will erect an electric light plant at this place. Mr. Solomon Lucas, of Norwich, Conn., is interested in the project.

STANHOPE, N. J.—Efforts are being made to establish an electric light plant at Stanhope and Netcong. The plan proposed is to light both places and the territory between the two towns.

HASTINGS, NEB.—The Hastings Electric Light Company's station was destroyed by fire on the morning of December 24 last. The loss on the building and plant is estimated at from $12,000 to $15,000.

PORT HURON, MICH.—A new company has been authorized to furnish electric light and power for this place. The franchise was granted to Seward L. Merriam, Edward F. Percival and Charles Wellman.

SYCAMORE, OHIO.—The people of Sycamore are moving for electric lights and water works. At the meeting of the council an election was ordered for January 17, to vote on the issuing of bonds to the amount of $20,000.

COLORADO SPRINGS, COL.—The County Commissioners have granted right of way to the Colorado Electric Power Company, which proposes to supply electric power for the use of the mines in the Cripple Creek district. The company's plant is located near Canyon City.

LOGAN, IA.—Local capital has just purchased the electric light plant in this place, and in the spring will survey to Magnolia, a distance of 7 miles, for an electric road for freight and passengers. Bids will be required on the work. Mr. Charles F. Luce is president of the company.

GALVESTON, TEX.—The Citizens Light & Power Company, of Houston, Tex., has been placed in the hands of a receiver on the application of the Massachusetts Loan & Trust Company, which is the holder of 150 first-mortgage bonds of the first-named company. The Electric Light & Power Company, it is stated, has defaulted on the interest of its bonds since September, 1896.

MILFORD, MASS.—Messrs. Smith & Webster, electrical engineers, of Boston, are drawing plans for the remodeling of the electric light station of this place. It is likely that bids will be called for the construction of the new plant. The present company not only intends to install new machinery and improved modern arrangements, but to introduce new lamps throughout its system.

ATCHISON, KAN.—The consolidation of the two electric light companies in this city has been accomplished, and the successor to the two interests is the Atchison Railway, Light & Power Company. The officers of the new company are: J. P. Pomeroy, president; W. P. Waggener, vice-president; C. S. Hetherington, treasurer; J. M. Chisham, secretary, and J. A. Bendure, superintendent.

CITY OF MEXICO, MEX.—A contract will soon be let for the electrical equipment of that part of the line of the Mexico street railway system running from Guadalupe to San Angel, a distance of 26 miles. On the completion of this improvement, which will probably be during the year, construction work will be pushed rapidly until the entire 140 miles of road owned by the company are changed over to the electric system. The syndicate which owns the Mexico city lines also controls the street railways of Barcelona and Lisbon and all of the systems in South Africa.

THE ELECTRIC RAILWAY.

FANWOOD, N. J.—It is proposed to build a trolley line from Fanwood to Scotch Plains.

NEW YORK, N. Y.—The Union Railroad Company will erect a power house for its Pelham Parkway extension.

CLINTON, MASS.—The Worcester & Clinton Street Railway Company will build a line from Clinton to Boyleston.

TONAWANDA, N. Y.—The Tonawanda Electric Railway Company, it is reported, will extend its line from here to Niagara Falls.

ST. PAUL, MINN.—The Street Railway Company has under consideration the changing of the Shelby Avenue cable to electric power.

NORTHAMPTON, MASS.—The Selectmen have granted a franchise to the Amherst & Sunderland Street Railway Company to operate in the city.

EAST BRIDGEWATER, MASS.—An electric railway is to be built from this place to Halifax. Selectman E. Scott Whitmarsh can give further information on the subject.

WALTHAM, MASS.—The Lexington Street Railway Company and the Newton Street Railway Company have petitioned the city for a franchise to operate lines in this city.

DEFIANCE, OHIO.—Mr. W. R. Faben, receiver of the Defiance Light & Railway Company, has been ordered by the court to advertise the sale of the company's street railway property.

FORT LEE, N. J.—The Bergen County Traction Company, now operating a trolley system between Fort Lee and Englewood, is making preparations to construct a branch from Leonia to Hackensack.

DANIELSON, CONN.—The Killingly Tramway Company has made a survey and taken other preliminary steps toward building a trolley road from Danielson, Conn., to several nearby places, including Dayville.

AURORA, ILL.—A company is being formed among the business men of this place for the manufacture of an electric railway signal. E. S. Hobbs, of the cotton mills, is president; E. D. Warner, of Jackson, Mich., who holds the patent, will be manager. A factory is to be started in Aurora.

PERSONAL NOTES.

MR. F. A. SCHEFFLER, who has just been appointed general superintendent of the Sprague Electric Company, was for a long time superintendent of the Brush Electric Company, in Cleveland. He is an excellent man for the position.

MR. CHARLES S. PEASE, formerly general superintendent of the Interior Conduit & Insulation Company, of this city, has assumed charge of the New York office of the Stirling Company, manufacturer of water-tube boilers, vice Mr. F. A. Scheffler, who has resigned to accept the general superintendency of the Sprague Electric Company.

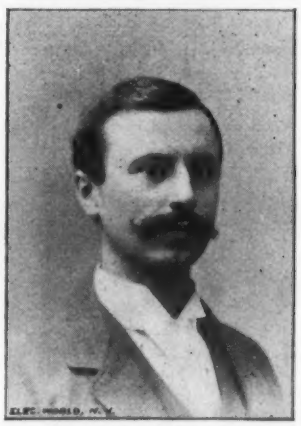
MR. GEORGE O. PROCTOR, president of the Anchor Electric Company, Boston, Mass., was born in Rockingham, Vt., February 23, 1847, and is a descendant of the well-known Proctor family of that State. His early life was passed on the farm, and his education was obtained in the schools of his native town, and in the Chester, Vt., Academy. He followed the occupation of farming and lumbering until 1874, when he came to Boston and formed a copartnership with his brother in the grain business, under the firm name of Proctor Brothers, which is still in existence, and one of the largest establishments in the hay and grain business in the vicinity of Boston. Mr. Proctor is well-known for his excellent business qualities and social prominence. He is a resident of Somerville, Mass., and is a director in the Somerville National Bank; president of the Lynn Trust Company; a member of the Boston Chamber of Commerce, and conspicuous in Masonry and other organizations. He served creditably in the Massachusetts Legislature of 1892, occupying a position on the committee on street railways, was re-elected in 1893, and placed on the committee on cities. The Anchor Electric Company is regarded as fortunate in having the benefit of Mr. Proctor's experience, influence and business sagacity.

GEORGE O. PROCTOR.

MR. GUY H. PROCTOR, vice-president of the Anchor Electric Company, is a son of G. O. Proctor, and has been selling agent for the Conant Rubber Company, of Boston, for the past two years. He commenced his business career with the Boston Rubber Company as office boy, and, in order to master the rubber business as thoroughly as possible he also entered its factory, where he gained a practical experience in every detail. He afterward had charge of the company's Chicago branch, and was selling to the largest buyers in the country. He relinquished the Chicago connection to accept the position with the Conant Rubber Company. Mr. Proctor possesses an inventive turn of mind, and, with the assistance of Capt. Samuel Abbott, of the Boston Protective Department, he designed the protective cover now in use in most of the protective departments in the country, designing also many other important improvements in rubber goods. He is a young man, and brings to the company business qualifications and energy that will no doubt secure for him as good a reputation in the electrical field as he unquestionably enjoyed in the rubber field.

GUY H. PROCTOR.

MR. NORMAN MARSHALL, treasurer of the Anchor Electric Company, was born in Hampstead, N. H., in 1864. Until he was sixteen years of age his life was divided between the country school and the farm. His first business experience was in the office of an architect and civil engineer, a profession for which he had manifested a preference. He finally entered the Worcester (Mass.) Polytechnic Institute, from which he graduated S. B. civil engineer in 1886. He became identified at once with the Marr Construction Company, and during his connection with this firm assisted in the construction of some of the first Edison central stations built, becoming ultimately a superintendent of the company. He had charge of several plants, including those at Altoona, Pa.; Dayton and Columbus, Ohio; La Crosse, Wis.; Birmingham, Ala.; Fort Worth, Gainesville, Marshall and Houston, Tex. Returning from Texas in 1889, Mr. Marshall assumed charge of the New England office of the Marr Company, and later was district engineer of the Westinghouse Electric & Manufacturing Company, having charge of its engineering department in New England. He resigned this position in the spring of 1892 to engage in the manufacturing business on his own account, organizing a new business in Philadelphia, which, after two years, removed to Boston. This business grew from a small plant, employing about a dozen men, until at the time the Iona Manufacturing Company was



NORMAN MARSHALL.

merged in the Anchor Company the factory gave employment to about fifty men. In the last three years Mr. Marshall has attended entirely to the manufacturing end of the business of the Anchor Electric Company, and now assumes, in addition, the financial management of the concern, whose business has about doubled since its organization three years ago.

Legal Note.

A WRIT OF MANDAMUS compelling the New York State Comptroller to transfer to the credit of the Western Union Telegraph Company a tax credit of $5789, made in favor of the Panama Railroad Company about six years ago and transferred to the telegraph company, has been granted by Justice Fursman, at Troy.

Trade and Industrial Notes.

THE FIRM NAME OF THE SULZER-VOGT MACHINE COMPANY, Louisville, Ky., has been changed to the Henry Vogt Machine Company. There will be no change of officers, and the management of the company will be the same as heretofore.

THE MENOMINEE ELECTRIC & MECHANICAL COMPANY, Menominee, Mich., manufacturer and dealer in general electrical supplies, and fan motors, is in line this year with all progressive concerns. It has just issued a neat little catalogue for 1898.

MR. ALFRED F. MOORE, manufacturer of insulated wires and cables, 200-202 North Third Street, Philadelphia, is distributing a monthly calendar for 1898. It possesses the very important merit of having the figures sufficiently large and plain to be easily distinguished at a distance.

THE CHICAGO BELTING COMPANY, Chicago, has just sold to Maxwell Brothers Box Factory, Chicago, the largest belt in the city. This belt is 150 feet, 72-inch triple ply. The Chicago Belting Company has closed enough business to keep it running full time for the next three months.

DRAUGHTSMEN will be interested in the new pamphlet issued by the Morse Machine Company, of Rochester, N. Y., which describes the draughting-room furniture made by this company. Some new apparatus in this line is described and illustrated. The company is making some new blue printing apparatus, cabinets and tables.

CORRECTION OF A MISPRINT IN LAMP CATALOGUE.—The General Electric Company desires to advise all holders of its complete Incandescent Lamp Catalogue, No. 1012, of an error in the appendix, in the table on page 58. The figures .662 in the column "Life Factors" should be .562. The company requests that all holders of the catalogue make this correction.

THE CHERRY ELECTRIC WORKS, 25 and 27 Third Avenue, New York City, is manufacturing very serviceable and inexpensive ammeters and voltmeters, which will be found very useful by amateurs and others, in experimental and practical work. Being scientifically designed, well made and of excellent appearance, these instruments will no doubt meet with a large demand.

THE HOBART ELECTRIC MANUFACTURING COMPANY, Troy, Ohio, is doing a very active business in the line of electric generators. Among the recent orders was one for a 1000-light dynamo for the municipal electric light plant at Cando, N. Dak. The company's business has been so heavy during the past month that night work had to be carried on.

THE C & C ELECTRIC COMPANY enjoyed a busy month during December last. Mr. Campbell Scott, the general sales agent of the company, states that the demand for the C & C new types of ironclad and multipolar machines continues to be most satisfactory. By dint of hard work the company is beginning to catch up with the orders, and expects to shortly be able to fill them with greater promptness. The company's works, at Garwood, N. J., are still being run every night.

THE DAVIS & EGAN MACHINE TOOL COMPANY, Cincinnati, Ohio, again finds it necessary to increase its capacity, owing to the growing foreign and domestic trade. The company has secured the plant formerly occupied by the Walton Iron Company, located in Covington, Ky. It is of modern construction, and will be equipped with electric traveling cranes, electric generators and all modern appliances. The new plant will be used for the manufacture of large lathes, planers and boring mills. The company expects to have it in operation within the next sixty days, employing a force of 300 men.

A TELEGRAPHIC CODE has just been issued by Mr. Charles Stewart, St. Paul, Minn. It is in the form of a small paper pamphlet. By means of the code any number from one to 1,000,000 can be expressed by a single word of not more than ten letters. The code includes two tables of numbers, one giving the literal equivalents for numbers from one to 999 and the other for numbers from 1000 to 990,000. By combining the literal equivalents any number within the range of the code can be expressed in one word. The units, tens, hundreds, thousands, etc., are expressed literally by words or syllables of two or three letters.

THE MANUFACTURERS & INVENTORS ELECTRIC COMPANY, New York, has a unique sign in front of its establishment, which is located on the corner of Fulton and William Streets. The sign has a curved face, and is placed on the corner of the building, so that it may be seen from both streets. The company's trade mark is represented on the sign, and under it is a four-blade fan, which is kept in constant rotation by an electric motor concealed from view. The revolving fan does not fail to attract passers-by. The company, through its manager, Mr. T. J. Smith, has just taken the agency for the graphophone. In this connection it is interesting to note that Mr. Smith exhibited the third phonograph made by Mr. Edison. He took it to South and Central American countries and gave exhibitions there, twenty-one years ago

PREPARATIONS FOR THE ELECTRICAL EXPOSITION.—Interest in the Electrical Exhibition, which is to be held at Madison Square Garden, New York City, next May, is growing. Contracts are already in for more than half of the total space sold at the 1896 exhibition. At that time more space was sold just prior to the opening than was disposed of during the earlier months, and if the same conditions obtain in the case of this year's show, the late applicants for space will be the losers. At the 1896 exposition there were 300,000 admissions. The managers of this year's exhibition expect that the number will run up pretty close to the million mark. There is every indication that there will be a large and varied exhibition of boiler, engine, pump and steam specialties. The exhibits, on the whole, will not only be larger and more varied than those at the previous show, but will be more accessible.

THE MAGNOLIA METAL COMPANY, New York City, informs us that an injunction was granted on December 15, 1897, by Lord Chief Justice Russell, in the Queen's Bench Division of the Court of Justice, London, England, enjoining the Tandem Smelting Syndicate, Limited, and restraining it from passing off its metal for Magnolia metal, which, it is stated, is made up to counterfeit the latter. A few months ago a firm in South Africa ordered Magnolia metal from the Globe Engineering Company, Limited, Manchester, England (now in liquidation). The metal that was sent was made up into ingots to represent as nearly as possible ingots of Magnolia anti-friction metal. The purchasers brought an action in the High Court of Justice at the Manchester Assizes against the sellers, and judgment was given in their favor. The Magnolia Metal Company offers $1000 reward to anyone causing the arrest and conviction of any individual or firm infringing its trade marks or patents.

THE CHLORIDE OF SILVER DRY-CELL BATTERY COMPANY, Baltimore, Md., has just issued a catalogue of medical batteries, which is one of the most complete and comprehensive ever produced,, if, indeed, it does not lead. In its production due regard has been given to artistic effect. The catalogue contains views of the different departments of the company's factory and a general description of chloride of silver batteries. The advantages of the company's silver dry cell are pointed out in a very clear manner, and the various stages of its construction, from the crude material to the finished product, are well described. Excellent illustrations and descriptions of the different styles of apparatus made by the company are also given. These include galvanic batteries assembled in various forms for different uses, the Willans current controller, milliammeters, and Faradic batteries of divers forms. The company also manufactures wall cabinets, table cabinets, electrodes and accessories. The hospital ward rolling table is also described and illustrated very clearly. At the back of the catalogue are given various testimonials which indicate that the apparatus of this company is giving satisfaction.

Business Notice.

NEW FACTS ABOUT SOUTH DAKOTA.—To enable the farmers in the Eastern States to pass the long winter evenings in an entertaining and instructive manner, the Chicago, Milwaukee & St. Paul Railway Company has recently published, for free distribution, a new pamphlet, finely illustrated with pictures which will delight the eyes of Eastern farmers, and containing letters from their brethren in South Dakota descriptive of their experience while tilling the soil and raising cattle, sheep and hogs in the "Sunshine State." This pamphlet is well worth reading through from cover to cover. It will be sent free, if you will send your address to either H. F. Hunter, Immigration Agent, 291 Dearborn Street, Chicago; or to Geo. H. Heafford, General Passenger Agent, Old Colony Building, Chicago, Ill.

Illustrated Record of Electrical Patents

UNITED STATES PATENTS ISSUED JANUARY 4, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

596,483. ELECTRIC FAN; O. F. Conklin, Springfield, Ohio. App. filed June 17, 1897. The combination with an outer casing or ring formed cylindrical on the inside, an armature shaft extending through said casing or ring, and having bearings therefor, field magnets within said ring or casing, and having core pieces enlarged at one end and curved to conform to said armature, and connected by a central neck or waist to the cylindrical casing at the other end, the field-magnet coils being formed on said central neck or waist portions, and held in place by the enlarged portion of the cores. and curved to conform to the space between the curved portions of the pole pieces and the inner periphery of the supporting ring.

596,506. ELECTRIC SWITCH; W. S. Hill, Hyde Park, Mass. App. filed May 1, 1896. In an electric switch, the combination of the blade formed in the same near an end thereof, and having an opening leading from said recess through the end of the blade to the exterior of the same, a yoke, an insulating clock placed intermediate of said blade and yoke, a nut seated in the recess formed in said blade, and a screw passing through said yoke, insulating block and the opening in the end of said blade, and engaging with said nut.

596,509. SIGNALING APPARATUS FOR TELEPHONE SYSTEMS; F. J. Holmes, Cleveland, Ohio. App. filed March 25, 1896. In a telephone or telegraph system, the combination of a device for varying the resistance in the line circuit one or more times, an electrically operated signal indicator connected in a local circuit, a plurality of devices which are adapted when connected severally in said local circuit to vary the resistance in said circuit, according to a code, and mechanism adapted to be operated by varying the resistance in the line circuit for conecting in the local circuit any desired one of said devices.

596,512. AUTOMATIC STOP-MOTION SNAP SWITCH; J. D. Ihlder, Yonkers, N. Y. App. filed Aug. 11, 1896. The combination with a switch and traveling means for operating it, of connections between the switch and traveling-operating means constructed and arranged so that on moving the traveling-operating means in one direction the connections will then permit the continuous movement of the traveling-operating means without affecting the movement of the switch, but will initially operate the switch on a reversal of the movement of the traveling-operating means.

596,515. STARTING BOX FOR ELECTRIC MOTORS; J. D. Ihlder, Yonkers, N. Y. App. filed Oct. 11, 1897. In a starting box for electric motors, the combination with the switch, of a shaft, an arm connected to the shaft for operating the switch, a resistance device in the circuit, a brush-carrying arm loosely mounted on the shaft, and connections between the arms whereby when the switch-operating arm is moved in one direction the brush-carrying arm is free, and when it is moved in the other direction it is moved with the switch-operating arm.

596,535. APPARATUS FOR EXTRACTING GOLD, ETC., FROM DRY CRUSHED ORES; E. L. Oppermann, London, England. App. filed March 11, 1897. An improved apparatus for effecting the amalgamation of gold and other metals in ores, consisting of a retort in which the mercury is heated; a pipe or pipes connecting the retort to the injector; a pipe or pipes connecting said injector to a supply of steam under pressure; a series of perforated pipes through which the mixed mercury, vapor and steam are blown under pressure upon the crushed ore; a mixer having rotating arms in which the ore is mixed; a pipe or pipes for conveying steam to said mixer; electrodes carried by moving supports and forming one terminal of a circuit; a channel having a metallic bottom, over which the ore passes, forming the other terminal, and over which said electrodes depend; a rotating pan having electrodes in same; and a fixed projection for agitating the contents of the pan.

596,567. CONVERTER FOR MONOPHASE CURRENTS; A. Blondel and G. Sautter, Paris, France. App. filed June 27, 1895. A converter for the transformation wholly or partially of a monophase-alternating current into a continuous current, or vice versa, comprising an armature carrying two windings, a primary winding fed by the alternating current to be transformed, and a secondary winding delivering the continuous current through a commutator, this armature being surrounded by a magnetic circuit, formed by a fixed frame carrying a closed-coil tertiary winding set in the pole pieces, the tertiary winding having for its object to transform the simple alternating field into a constant field fixed in space.

596,582. MEANS FOR VARYING CANDLE POWER OF INCANDESCENT ELECTRIC LAMPS; C. E. Felch, Natick, Mass. App. filed June 21, 1897. In a socket for incandescent electric lamps, a rotatable shell, a carrier of insulating material mounted therein and having a recess, a permeable resistance medium held in said recess, an electrode adapted to be extended into said medium, and means connected with and actuated by rotation of the shell to effect relative movement of said electrode and carrier within the shell, and thereby extend the electrode into the resistance medium to different depths, said medium and electrode being in electrical circuit with the lamp filament and the line.

596,609. SUPERVISORY SIGNAL FOR TELEPHONE SWITCHBOARDS; F. R. McBerty, Downer's Grove, Ill. App. filed Oct. 26, 1896. The combination with a telephone line and means for altering its electrical condition, of a signal indicator associated with the line, a magnet controlling the indicator responsive to currents in the line, an appliance whose position or condition is altered during connection with the line, and a mechanical device actuated in the movement of said appliance adapted to act upon the indicator in the same manner that the magnet does.

596,610. SIGNALING SYSTEM FOR TELEPHONE TRUNK LINES; F. R. McBerty, Downer's Grove, Ill. App. filed Nov. 24, 1896. The combination with a subscriber's line terminating in a spring jack, a trunk line and a plug connected with the trunk line and adapted for insertion into the spring jack, of a signaling circuit including a clearing-out signal at the distant terminal of the trunk line, said signal being adapted to be displayed when its controlling magnet is inert, the signaling circuit being completed through registering contact pieces of the subscriber's spring jack and the plug therein, and a source of current permanently connected with the signaling circuit to excite the said signal-controlling magnet, whereby the withdrawal of the plug from the spring jack causes the display of the clearing-out signal.

596,625. PLUG AND SPRING JACK FOR TELEPHONE SWITCHBOARDS; C. E. Scribner, Chicago, Ill. App. filed Nov. 29, 1895. The combination with a spring jack, having a tubular contact thimble and a contact spring, of a plug having a contact ring for the said contact spring and an insulating ring of larger diameter than the said contact ring placed before the said contact ring, whereby the ring is prevented from touching the contact thimble.

596,626. SPRING JACK FOR TELEPHONE SWITCHBOARDS; C. E. Scribner, Chicago, Ill. App. filed May 14, 1896. The combination with a switch spring lying on edge in a groove in a base plate, of a bolt through the said base plate, having a nut of disc-like form, with a lateral extension, said nut lying in a countersunk opening of the base plate, and said lateral extension being in engagement with a recess in the switch spring.

596,627. ANNUNCIATOR FOR TELEPHONE LINES; C. E. Scribner, Chicago, Ill. App. filed May 14, 1896. The combination with a closed signaling circuit, of an annunciator having its winding together with a resistance coil in the signaling circuit, a source of current in a normally open shunt about the resistance coil, switch contacts in the annunciator actuated by the excitement thereof to close the said shunt, and a switch adapted to break the circuit of the battery through the annunciator.

596,628. SUPERVISORY SIGNAL FOR TELEPHONE SWITCHBOARDS; C. E. Scribner, Chicago, Ill. App. filed Nov. 16, 1896. The combination with a telephone circuit, a magnet therein, a target or indicator controlled by the magnet and adapted to be moved from its normal to its other position when the current in the line is changed, a key controlling the connection of the operator's telephone with the line, of a mechanical connection between the key and indicator to control the signal independently of the current in the line.

596,629. TESTING APPARATUS FOR MULTIPLE SWITCHBOARDS; C. E. Scribner, Chicago, Ill. App. filed Dec. 8, 1896. The combination with a telephone line, spring jacks therefor in different sections of a multiple switchboard and test contacts in the spring jacks, of a relay responsive to currents in the line, and a signal controlled thereby, a cut-off relay adapted to interrupt the current through the said signal-controlling relay when excited, and means for applying current to the cut-off relay in the act of making connection with the spring jack, a source of electric current, and a circuit therefrom to the test rings closed by switch contacts actuated by the said signal-controlling relay; whereby the circuit connecting the battery with the test rings is closed when the signal-controlling relay becomes excited, and is broken when connection is made with the line.

596,630. APPARATUS FOR TELEPHONE SWITCHBOARDS; C. E. Scribner, Chicago, Ill. App. filed Dec. 8, 1896. The combination with a telephone line, means for making connection therewith, an electromagnet associated with the telephone line, and mechanism actuated by the electromagnet, of a local circuit including the electromagnet, together with a supervisory signal, a relay responsive to currents in the line and a shunt of the said signal controlled by the relay.

596,654. PROCESS OF PRODUCING HIGH VACUUMS; E. F. Dwyer, Lynn, Mass. App. filed Oct. 26, 1897. The process of producing high vacuums, consisting in removing the main portion of the gases contained within the receptacle to be exhausted by pumping, heating the remaining gas while continuing the pumping, driving off occluded gases, and producing or evolving a condensable or displacing gas by an electric current passed through a circuit within said receptacle, and finally sealing said receptacle.

596,680. ALARM-CLOCK ATTACHMENT; P. C. Howe, Boston, Mass. App. filed April 15, 1897. The combination of an alarm clock, a thermostat, of means operated by the thermostat for releasing the alarm train of the said clock, and of a circuit breaker operated by said alarm train.

596,719. MAGNETIC ORE SEPARATOR; L. G. Rowand, Camden, N. J. App. filed April 15, 1897. In a magnetic separator, the combination of a conveyor belt adapted to convey the material to be treated, a discharging belt passing over and beyond and at an angle with the conveyor belt, a magnet above said belts at the crossing point, and extending above the discharge belt beyond the conveyor belt, the pole pieces of the magnet extending along said discharging belt, the distance between the pole pieces increasing along said discharging belt beyond the conveyor belt.

596,720. MAGNETIC ORE SEPARATOR; L. G. Rowand, Camden, N. J. App. filed April 15, 1897. In a magnetic separator, the combination with a conveyor adapted to carry the material to be treated, of a magnet above said conveyor and adjacent thereto, the pole pieces of said magnet extending toward each other at their ends, and provided with an open-bottomed space between the free ends of the pole pieces, the ends of the two pole pieces being covered with non-magnetic material extending above their upper surfaces.

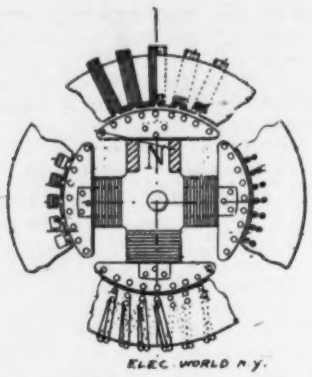
596,729. SUPPORT FOR ELECTRIC LAMPS; O. C. White, Worcester, Mass. App. filed Feb. 16, 1897. The combination of a support, a pipe pivotally connected thereto, a ball secured to the end of said pipe, an electric lamp fixture, a ball connecting thereto, yoke pieces, and a single clamping device for adjustably clamping said pieces into engagement with the balls.

596,774. ELECTRIC SIGNALING APPARATUS; F. B. Herzog, New York, N. Y. App. filed May 31, 1895. An annunciator, comprising a receptacle containing a transparent electrolyte, and a series of electrodes located therein, visible therethrough, and corresponding to a series of sub-stations; separate lines connecting these electrodes to the various sub-stations; a circuit-controlling device located at each sub-station and adapted to control the flow of current through said electrode, and electrolyte being relatively so constituted that variations in the current passing through any one or several of the electrodes will produce, in the annunciator, electrochemical reactions of a character adapted to vary the appearance of each of these electrodes, and thereby locate the operated sub-stations.

596,791. VOLTAIC BATTERY; H. E. De Rufz de Lavison, Neuilly-sur-Seine, France. App. filed May 28, 1897. A voltaic battery, comprising an electrolyte, positive electrodes immersed therein, and movable negative electrodes, of oxidizable metal in combination with means for heating the negative electrodes up to the point of oxidization, and means for raising portions of the said negative electrodes into the oxidizing atmosphere while the remainder is in the electrolyte, whereby the battery is depolarized.

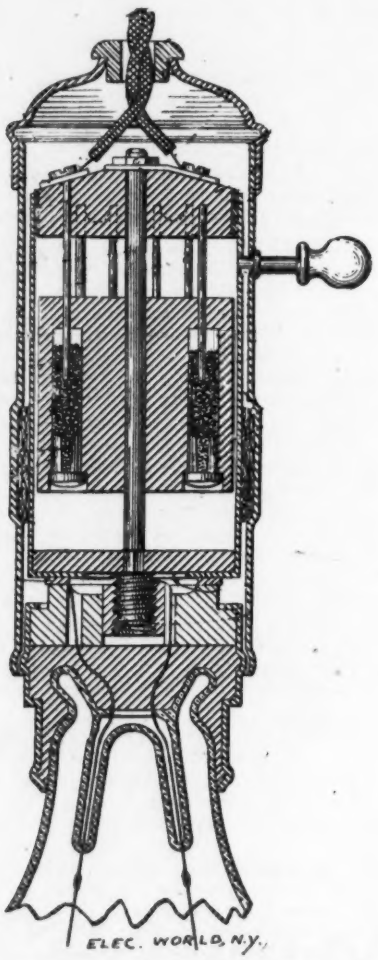
596,806. APPARATUS FOR TELEPHONES; F. B. Cook, Chicago, Ill. App. filed March 17, 1896. In a telephone system, two connected subscribers, a central office, means for preventing the calling of one subscriber when the other subscriber rings off, consisting of calling generators at each subscriber's station unresponsive to the current from the calling generator of the other subscriber.

596,808. TELEPHONE TRANSMITTER; D. A. Fleming, Indiana, Pa. App. filed April 12, 1897. A telephone transmitter, having a diaphragm, a tube or channel mounted to turn adjacent to the diaphragm and inclined relatively to the axis of rotation, the tube being mounted to turn without affecting the fastening of the diaphragm, and loose conducting material, such as balls, in said channel and engaging the diaphragm.



No. 596,567.—Converter for Monophase Currents.

596,812. SUBTERRANEAN ELECTRIC CONDUIT; W. D. M. Howard, Redwood City, Cal. App. filed June 18, 1897. The combination with a conduit, provided with a slot or channel, of a hollow tube interior to the conduit, having a channel in its bottom and inturned edges forming guide rails, vertical standards fixed in the conduit, and passing through the channel of the tube and into the interior of said tube, and secured to the inner circumference thereof, trolley wires or rods within the tube and supported from the standards, and a plow having guide wheels to engage the inturned edges of the tube.



No. 596,582.—Means for Varying Candle-Power of Incandescent Electric Lamps.

596,824. EXHIBIT PROTECTOR; H. J. Olney, Cedar Rapids, Ia. App. filed March 13, 1897. In an exhibit protector, the combination with a lower platform, of an upper platform movable toward and away from the lower platform, a normally inflated pneumatic tube located between the platforms, and on which the upper platform rests and is supported, an alarm, and mechanism operated by the expansion of said tube to sound the alarm when pressure on the upper platform is released.

596,834. TELEPHONE TRANSMITTER; J. H. Spencer and M. S. Keyes, New York, N. Y. App. filed Jan. 14, 1897. A telephone transmitter provided with buttons, and granulated German silver held between the buttons.

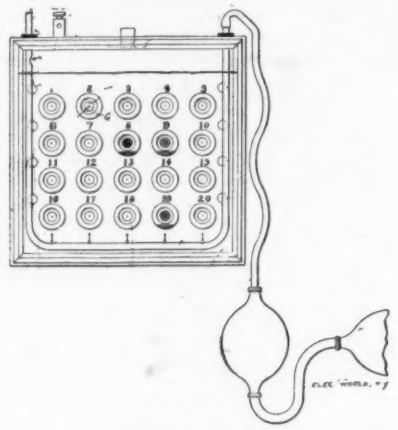
596,850. TELEPHONE-SWITCH PLUG; F. B. Cook, Chicago, Ill. App. filed Jan. 4, 1896. A plug for complete metallic circuits, consisting of a main body portion, comprising a head and conductor-holding members, or sections insulated from each other, an insulating partition for insulating the section, binding screws in each of said sections located on each side of said partition, and conductors led and secured to said screws, whereby the partition isolates the conductors to prevent short-circuiting, together with a conducting sleeve connected with the head aforesaid, and a conducting stem connected with one of the conductor-holding sections aforesaid.

596,851. TELEPHONE APPARATUS; F. B. Cook, Chicago, Ill. App. filed Oct. 23, 1895. An organized self-containing single piece of switchboard apparatus designed to accomplish the various specified functions, and comprising in organization a pivotal manually vibrated key lever, a rotatable switching bar, having projections, cord-circuit operator's signal and clearing-out signal contacts, a connecting conductor between the operator's contact and the clearing-out contact, which also connects the cord-circuit contacts, a connecting conductor with which the signal-generator circuit is connected and ringing keys for ringing out on either cord circuit, whereby the cord-circuit contact over which the signal is to be sent may be brought against the connecting conductors with which the generator circuit is connected, the switch bar and key operating the same serving to bring the operator's circuit contacts against the cord-circuit contacts or the clearing-out circuit contact against the cord-circuit contact.

596,852. SWITCH FOR TELEPHONE CIRCUITS; F. B. Cook, Chicago, Ill. App. filed Dec. 1, 1896. In an electric switch a pair of crossed springs adapted for contacting at two points on the opposite sides of each, and means for operating the springs, whereby to establish or disestablish the aforesaid contacts.

596,907. ELECTRIC CABLE FOR PROPULSION OF VEHICLES; A. Norman, Toronto, Canada. App. filed July 8, 1896. In an electric cable for the propulsion of vehicles, the combination of the supply conductor made of one or more strands of wire, and covered throughout its whole length with insulating material, except where it is inclosed by short metal switches with the working conductors and switches knit into one rope.

596,923. AUTOMATIC POTENTIAL REGULATOR FOR DYNAMOS; A. A. Tirrill, Whitefield, and P. S. Tirrill, Groveton, N. H. App. filed May 1, 1897. An automatic potential governor for dynamos, consisting of one or more vertical solenoid coils, arranged in a branch of the main supply circuit, a vertical core for each solenoid, a lever fulcrumed above and outside of the solenoid, and attached to and suspending the core of the solenoid, contact points arranged as terminals to a shunt from the field magnets of the dynamo, one of said contact points being stationary, and the other mounted upon the lever and movable, and a spring and adjusting



No. 596,774.—Electric Signalling Apparatus.

device attached to the said lever for balancing the solenoid core and adjusting the sensitiveness of the contact.

596,926. TROLLEY GUARD; H. J. Vogler and A. Flores, San Antonio, Tex. App. filed Oct. 16, 1897. The combination with the trolley wheel and its axial bolt, of bowed or loop-shaped guards hung loosely on the axial bolt on each side of the trolley wheel, and a spring on each side of the trolley wheel, and a spring on each side connected at one end rigidly to the axial bolt, and extending radially into the bow of the guard and secured within said bow to the middle of the outer portion of the same.

596,943. ELECTRIC CLOCK; F. Richard, Lynn, Mass. App. filed Nov. 24, 1897. In a clock or timepiece operated by a balance wheel, whose vibration is accelerated or renewed automatically as needed, the combination of electromagnets, armature balance wheel, spindle, hairspring automatic contacting devices, consisting of radial notched arm, pallet and spring, the radial actuating arm and pendulous arm connected for transmitting the motion of the balance wheel to the clock mechanism.

596,955. AUTOMATIC TEMPERATURE REGULATOR; A. A. Boss, Detroit, Mich. App. filed March 31, 1897. In an automatic temperature regulator, the combination with an electric circuit, having a circuit closer therein, of an electromagnet, the movable armatures, a valve case and valve therein, a lever for actuating said valve, and a connection coupling said armatures to said valve-actuating lever, said connection being of such a character as to permit said armatures to attain their maximum velocity when attracted before acting upon said lever.